
DRAFT SFWMD Water Supply Contingency Plan

Attachment I --Descriptions of Proposed Water Supply Options



August 21, 2001

**South Florida Water Management
District**

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1. Lake Okeechobee Water Supply Augmentation and Backpumping

DESCRIPTION

This option represents the identification of additional water that could be added to the Lake through the use of temporary pumping facilities, gravity inflows, or operational changes. This option can thus benefit all water users who rely on Lake Okeechobee for water supply. Staff has estimated that approximately 370,800 acre-feet of water could be captured at an approximate cost of \$855,000.

IMPLEMENTATION

The SFWMD has responsibility for implementation of this option and provides the necessary services and funding. The components of this option include the following:

- Installation and operation of approximately six 100-cfs temporary pump stations -- four stations at S-78, and two at S5AE.
- Modified operations of S-4 and gravity inflows at S-352 and C-10A, and
- Water quality and biological monitoring at all of the sites covered under FDEP authorization (Emergency Order OGC 01-1202 Dated August 3, 2001).
- Operation of pump stations S-2 and S-3 to backpump water from the EAA into the Lake.

Temporary facilities or operational changes are needed at S-78, S-4, S-5AE, S-352. S-2 and S-3 will continue to have backpumping operations in effect in accordance with the terms of the 90-day FDEP emergency order.

In order to fully implement this option, the District needed to receive a new emergency order or other authorization from the FDEP allowing the temporary facilities and operational changes. This order was issued on August 3, 2001. In addition, the District needs permission from the United States Army Corps of Engineers (USACE) to install temporary pumps at the Ortona Structure (S-78). The District will need to mobilize staff from the Operations area to install the pumps, dive crews will need to be contracted, fuel delivery and routine O&M of the facilities will have to be arranged.

TIMING

This option needs to be implemented immediately to realize maximum benefits by capturing wet season runoff. Benefits may be substantially or totally lost if the facilities and operational changes are not in place prior to the end of the 2001 wet season. The first phase of this option was authorized by the SFWMD Governing Board on July 11, 2001. Parts of the option are already underway and full implementation is expected to be underway within 60 to 75 days.

The USACE structural engineering unit needs to inspect the temporary installation before operations are initiated. Engineering analysis continues on S-5AE option, and the FDEP is coordinating with the SFWMD regarding the need to continue or extend the emergency order or obtain other authorization to continue backpumping under appropriate conditions .

BENEFITS AND COSTS

The non-monetary benefits of this project include increased stages in Lake Okeechobee during a serious drought, increased operational flexibility, and increased water levels before the start of the dry season, which will provide a “cushion” for the coming dry months. The costs include potential short-term environmental impacts that may occur, depending upon water quality of water entering the Lake.

Early estimates of the total monetary costs (including capital expenditures, manpower, operations and maintenance) to implement this project are about \$855,000. This project can provide an estimated 370,800 acre feet of additional water, which can be placed in regional storage in Lake Okeechobee. This quantity is based on the assumption that backpumping operations at S-2 and S-3 continue until at least 11/3/01, when the authorization expires (or until the lake is above 11.0 ft NGVD for 30 days) and other augmentation operations at S-77, S-4, S5AE, and S-352 continue for 90 days with the possibility of a single 90-day renewal. Based on these estimates, the cost per unit of water produced is about \$2.31/acre-foot.

REFERENCE

South Florida Water Management District, 2001. Water Quality and Biological Monitoring Plan for Lake Okeechobee Backpumping And Water Supply Augmentation. West Palm Beach Florida. August 1, 2001. 13 pp.

2. Water Conservation Area Schedule Deviations

DESCRIPTION

Temporary deviations to the regulation schedules of Water Conservation Areas 1, 2A and 3A have been requested from the United States Army Corps of Engineers (USACE). These deviations are designed to lower the “floor elevations” for each Conservation Area in conjunction with lowering canal maintenance levels in the lower east coast service area. These two actions will allow the District to reduce the dependency on water from Lake Okeechobee to meet the water supply needs of the lower east coast.

IMPLEMENTATION

The Water Supply Division has project management responsibility for this plan element. The required services, primarily District staff time, will be provided by staff of Water Supply, Watershed Management, Legal and Operations Control.

Successful implementation of this plan element will benefit all utilities that depend on water from Lake Okeechobee. The first step of the process is to conceive and model the deviations and then make a formal request to the USACE) to allow the deviations. This step was accomplished by July 2, 2001. Additional steps will require working with the USACE staff to assist them in implementing their process, which includes consultation with the US Fish and Wildlife Service (USFWS), Florida Fish and Wildlife Conservation Commission (FWC) and other affected parties. As the requested deviations could affect water levels in sensitive environmental habitats of several threatened and/or endanger species, the USACE will probably be required to submit an Environmental Impact Statement (EIS) describing the effects of the deviations on sensitive species. Part of the EIS process will be to document the effects of not receiving the deviations and the identification of possible alternatives. Considerable staff time (especially the hydrodynamic modeling and Everglades Watershed Management group) may be consumed by the development and analysis of alternatives.

Since the July 2nd submittal, water levels in Lake Okeechobee have increased due to an abnormally wet July in South Florida. Therefore, the District has refined the previously submitted alternatives, and remodeled three new alternatives using more current water level data and revised projected drought conditions. The District's August 17th letter to the USACE has recommended deviation 9 as the preferred alternative. It is believed that this deviation will best achieve a balance between water supply and environmental needs by protecting wellfields and conserving critical water supplies, while minimizing for adverse impacts to the environment.

TIMING

The length of time required to complete this task will depend on the assessment of the impact of these deviations on the environment. If initial assessments conclude that implementation of these deviations will have a negative impact on the environment; an EIS will be required. Initial estimates of the time for the USACE to prepare an EIS is about 10 months (completion in February 2002). Unfortunately, the requested deviations should begin in January of 2002, to generate the maximum benefit. Considerable effort will be required to prepare and complete the EIS in the time frame favorable to the District. If delayed, the benefit will be reduced proportionally to the length of the delay.

BENEFITS AND COSTS

The benefits and costs of the implementation of this element will depend on which alternative deviation will be implemented. Three different alternatives have been submitted in the August 17th, 2001 letter to the USACE for their consideration. The projected benefits range from reducing the lower east coast dependence on water from Lake Okeechobee from 38% to 34%. The effects on the environment of implementing the three different alternatives have also been projected. Work to date indicates few differences among the three alternatives when compared to each other. A negative environmental effect of the alternatives, when compared to the “base, no deviation” condition, is that a general drying out of the system occurs in areas that are located near conveyance canals. Little or no impact is projected for the interior marsh study sites under any of the three alternatives based on evaluating model projections.

It should be noted that attempting to project water supply benefits and environmental impacts of this element over a 12-month period is difficult at best. Just as attempting to forecast the weather over a period of a year is subject to uncertainties, so is attempting to forecast environmental conditions and water supply needs. As such, there will be adjustments to both the amount of the deviation requested and the assessment of impacts due to these deviations, as we progress through the approval process. In turn, the costs and benefits of this plan element will change, becoming more firm and predictable as we move closer to actual implementation.

3. Upper Kissimmee Chain of Lakes Operational Flexibility

DESCRIPTION

October 2001 – February 2002 (consistent with past practices):

The Florida Fish and Wildlife Conservation Commission (FWC) is the local sponsor to the USACE for the Lake Toho Extreme Drawdown (SFWMD and FDEP are cooperating agencies). The option must be approved by USACE during the Environmental Impact Statement development and review process that is scheduled to be completed by November 1, 2001.

A drawdown of Lake Toho is proposed to commence from approximately mid-October 2001 to February 2002, representing a transfer of an estimated 106,000 ac-ft of water. To facilitate a gravity discharge from Lake Toho, it is proposed that Lakes Kissimmee-Hatchineha-Cypress will also have to be drawn down. The drawdown water would eventually flow into Lake Okeechobee.

March 2002 - (approx.) December 2002 (proposed flexibility):

Normally, S-61 (Lake Toho) and S-65 (Lake Kissimmee) would remain closed until the lakes returned to regulation schedule. Past history of similar drawdowns have shown that the lakes, particular Kissimmee-Hatchineha-Cypress (S-65) did not return to regulation schedule until the late fall (Nov-Dec) following the drawdown. The following flexibility and shared adversity operational strategies are proposed.

- a. March -May 31, 2002: a minimum of 400 cfs is released from East Lake Toho (S-58) and flows through S-61 and S-65. Also, during this period, discretionary Zone B releases are made from S-65 at a minimum rate of 300-400 cfs down to a lake stage of 48.0 feet NGVD. The combined effect of these actions is to transfer approximately 70, 000 ac-ft of water into the C-38 and ultimately to Lake Okeechobee.
- b. June – Nov 2002: the regulation schedules from East Lake Toho, Lake Toho, Lake Kissimmee-Hatchineha-Cypress are modified to follow a linear escalation from June 1 low stage to normal high stage in September-October (rather than a vertical increase of regulation schedule from low pool at May 31st to a high summer pool at June 1st). If the lake stages exceed the modified linear escalation, the excess water flows through the lakes into the C-38 and ultimately into Lake Okeechobee. These changes could potentially deliver an estimated 150,000 to 300,000 ac-ft of additional water into Lake Okeechobee

IMPLEMENTATION

Implementation of this option will affect operations of structures S-58, S-61, S-65, S-65A, S-65C, S-65D, S-65E in the Kissimmee Basin. The District contribution is primarily manpower (SFWMD operations staff) and the amount of time is not significant. The benefits of the drawdown include the ability to discharge more water into Lake Okeechobee. The primary impacts of the project will be a shared adversity of aesthetics and boater ease of navigation in the Kissimmee Upper Basin.

TIMING

This option needs to be implemented during the period from March 2002 to Nov/Dec 2002 in order to realize maximum benefits. If implementation of this option is delayed, waters remaining in the upper basin lakes are subject to evaporation losses.

BENEFITS AND COSTS

Lakes of the Upper Kissimmee Chain will see long term benefits to fisheries, wildlife and plant communities and lake ecology due to the drawdowns. These changes will in turn provide benefits to homeowners and the regional tourist economy.

Water storage will be essentially transferred from Lakes Toho, Kissimmee and Hatchineha-Cypress into Lake Okeechobee. This relocation of water will increase the depth of water in Lake Okeechobee without significantly increasing the surface area, thus reducing the overall amount of water that is lost to evaporation.

Other hydrologic effects of the drawdown include the following:

- a. East Lake Toho will have a slower “fill rate” to achieve summer high pool stage
- b. Lake Toho will have a slower summer “fill rate” after drawdown is complete (June 1, 2002)
- c. Lakes Kissimmee-Hatchineha-Cypress will have a slower “fill rate” after Lake Toho drawdown is complete

Costs of the project primarily involve SFWMD staff time and should be minimal. Additional costs of the project include loss of aesthetic values and boating access for lakeside residents and visitors during the drawdown period.

4. Cloud Seeding

DESCRIPTION

The potential to artificially induce rainfall through cloud seeding is strongly dependent on the natural microphysics and dynamics of the clouds (microphysics includes the size and concentration of water droplets and ice inside clouds). These factors can differ significantly from one geographical region to another and even between seasons in the same region. In some instances clouds may not be suitable for seeding, or the frequency of occurrence of suitable clouds may be too low to warrant the investment in a cloud seeding program. Both factors need to be evaluated in a climatological and microphysical sense.

Therefore, it is strongly recommended that preliminary studies on the microphysics and dynamics of naturally occurring clouds be conducted prior to commencing a larger experiment or any operational seeding program. Although cloud studies would have the highest priority, seeding tests are to be included as part of a cloud seeding project. These would likely be carried out using a randomized procedure in order to maximize their benefit to future studies.

Scientists from the Research Applications Program (RAP) of the National Center for Atmospheric Research (NCAR), in collaboration with university scientists, have agreed in the past to assist the SFWMD by conducting an assessment study for rainfall enhancement via hygroscopic cloud seeding should the District opt for a seeding program. The collaborative work may entail all necessary aspects of the project, including rainfall climatology studies, cloud physics measurements, radar data analyses and numerical modeling work, and should build on the experience obtained in programs in Florida and other parts of the world.

IMPLEMENTATION

Any decision to seed clouds for rainfall increase should be made by the District Governing Board in consultation with the District Executive Office due to a state of emergency, as declared by the Governor. Although such a declaration would exempt the District from the need to obtain a license from the Florida Department of Environmental Protection (FDEP), the District will follow emergency procedures, as described in Sec. 403.311, F.S., and provide the following information to the public:

- A description of the cloud seeding technique
- Chemical products used during cloud seeding
- The areas and times when chemicals will be used, and
- The areas that will be affected by increased rainfall.

A cloud seeding project needs to be thoroughly planned before it can be successful. For a relatively new cloud seeding method such as the hygroscopic technique, it is advised that, if circumstances allow sufficient time and resources, a two-phased approach should be taken to optimize rainfall increases over a specific basin. The first phase is a research-oriented endeavor in which the physical attributes of clouds are determined. The second phase is a full-scale cloud seeding deployment if the results of the first phase are satisfactory.

Phase 1

In order to conduct a scientific evaluation of cloud seeding for south central Florida, an initial 12-month assessment study consisting of the following components would be appropriate:

- A study of the cloud and aerosol climatology over central and south Florida to assess clouds microphysical characteristics and how they relate to rainfall distribution. These studies are important to determine if hygroscopic seeding is applicable to clouds in Florida.
- The collection of radar data in the region (Melbourne, Tampa Bay, and Miami) and implementation of the NCAR Thunderstorm Identification and Tracking Analyses (TITAN) software system. Real-time display and data archival are possible from the Melbourne radar system. Data from the radar system can be networked into one display to facilitate field operations and precipitation analysis.
- Analysis of radar data using the TITAN software to assess seeding experiments and the potential for rainfall increases in the area of interest.
- Analysis of the aircraft data (in concert with radar data) to determine the natural precipitation processes and the effect of seeding on these processes;
- Numerical modeling studies on the formation of clouds and rain to evaluate and assess the potential for additional water resources due to cloud seeding.

Climatologically, south Florida receives its major rainfall between May and September of each year with peaks in June and August. It is suggested that the field efforts be conducted during this period to allow sufficient opportunities to collect data and evaluate the potential for enhancing rain via cloud seeding. Prior to conducting the field program, an Operations Plan should be prepared under the direction of an Operations Director for the seeding experiment. This document should be distributed to all personnel involved with the project. The Operations Plan should provide flight plans, strategies and criteria for the seeding tests, and other details regarding the day-to-day operation of the project.

Phase 2

The final result of the Phase 1 study will be a recommendation on the suitability of seeding with hygroscopic flares in the SFWMD. If the physical characteristics of the clouds are suitable, and if their frequency of occurrence is high enough to make the option of operational seeding seem cost effective, then a recommendation would be made to move on to a second phase. In this second phase a randomized experiment would be conducted to demonstrate, using statistical methods, that an actual increase in rainfall occurs. A quantitative estimate of such an increase would be made, which can be used to initiate a cost-benefit analysis. The duration of such a second phase would depend on the frequency of suitable storms, and on the magnitude of the increase produced. Neither can be predicted before the seeding occurs.

In the event of a severe water shortage emergency, it may be desirable or necessary to forego or reduce the scope of the research phase and proceed directly to implementation.

TIMING

The timing of various processes in a cloud seeding project is critical to the success of the research phase. The following possible timeline is suggested for Phase 1, a 12-month research effort:

- May 1, Year-1 Start Program
- May-June Prepare for field program
 Implement TITAN using Melbourne NWS Radar data
 Start climatological and meteorological studies
 Initiate modeling plans
- June 15–September 15 Conduct field program with research aircraft
 Continue with above-mentioned studies
- September–April, Year2 Analyze the field program data
 Conduct meteorological and possibly hydrological
 studies using field program data
 Conduct simulations with numerical models using field
 program data
 Compile a final report with recommendations
 Assess the feasibility of a Phase Two program

BENEFITS AND COSTS

The initial cost of a cloud seeding project over the Upper Kissimmee basin, as proposed by Dr. Roelof Bruintjes who is one of the world's-leading weather modification experts at the NCAR, is about \$950,000. NCAR recommends a two-year timeline for a cloud seeding project. The estimated project cost over this time period is about \$1,700,000. Benefits/costs analyses conducted by the SFWMD indicated that each inch of average rainfall generated over the Kissimmee River Basin, contributed 63,000 acre-feet of flow at S65E, increasing the amount of water stored in Lake Okeechobee. A simple estimate shows that, if cloud seeding generated an additional one-inch of rainfall, the value of the additional rainfall would be on the order of 63 million dollars for water users of Lake Okeechobee. Theoretically, an increase in rainfall of 0.02 inches over the Kissimmee basin would therefore be the break-even point for the project, if the first year cost of about \$950,000 is used.

Previous cloud seeding experiments in Mexico and South Africa indicated that estimated rainfall, based on radar measurements at the cloud base, increased about 30-60%. Although it has not yet been proven that the above numbers can be achieved at ground level, these analyses suggested that cloud seeding may yield beneficial results when properly planned and carefully implemented.

5. Develop and Implement a New Supply Side Management Plan

DESCRIPTION

The original Lake Okeechobee Supply-Side Management (SSM) Plan is explained in the policy document (Hall, 1991) which is also commonly known as the “yellow book.” This policy describes the rationing of water stored in the lake during a particular dry season when the amount of water available to meet the demands of the service areas of the Lake is low. In the plan outlined in the “yellow book”, the rationing of water supply begins when the Lake level falls below the 13.5 to 11 SSM line shown in Figure 2 of the Water Supply Contingency Plan. This option was revisited in the Lower East Coast Water Supply Plan, which proposed the lowering of this line, by 0.5 feet. Although the SSM methodology calls for implementation of the supply-side rationing starting on October 1st, it was not implemented until November 29, 2000, during the 2000-2001 dry season. This delay was deemed necessary to provide relief to users around the Lake which had an extremely low level due to an ongoing severe drought and the managed recession during the April-May, 2000.

The SSM methodology also includes the concept of a “reference stage” associated with the ending date of the dry season (June 1st). The storage associated with the reference stage is used to calculate the allocable storage during the dry season along with expected net rainfall (rain - evapotranspiration) on the Lake. Although the reference stage recommended in the LEC plan was 10.5 ft. NGVD, the initial reference stage for the SSM implementation during the past dry season was 9.8 ft. NGVD. This was necessary to provide a minimal level of supply to users due to drought conditions more severe than what was assumed in the “yellow book.” In fact, many times during the 2000-2001 dry season, the reference stage needed adjustment to provide a minimum level water supply (40-50% of the demand) to the users of Lake Okeechobee water. Much lower level for reference stage was largely facilitated by the installation of the “forward pumps” which allowed the delivery of water supply at much lower Lake levels (<10 ft. NGVD) than before. The District recognizes the weaknesses of the current SSM plan and has initiated an effort to revise the existing “yellow book.”

During the 2000-2001 dry season, the District also developed a methodology to distribute the total weekly allocation among different subbasins around Lake Okeechobee. This distribution was largely based on individual demand of each subbasin as calculated using its crop and soil types. The water supply to Seminole tribal lands was excluded from normal SSM calculations as it had a separate water shortage cutback procedure negotiated when the Compacts were established. The water supply to most of the non-agricultural users were also excluded, but they were subjected various forms of rationing through other means. No water was provided from the Lake for irrigation of pasture

District has initiated the development of the new SSM procedure for the 2001-2002 dry season. The new methodology will include but are not limited to the following:

- Implementation of the SSM zone as recommended in the LEC plan (13.0 ft. to 10.5 ft. line from October 1st through June 1st)
- Improved assumptions regarding expected rainfall, evapotranspiration and inflows during the dry season.

- Improved subbasin distribution methodology to account for recent rainfall history in each subbasin, crop types and soil types. Installation of several new rain gages and weather stations will be necessary to cover “gaps” in the current coverage of climatic data.
- Flexibility to account for conditions that may occur due the recurrence of a very severe drought again during the upcoming dry season. The options will include availability of “forward pumps” for water supply.

IMPLEMENTATION

Steps needed to implement this option are outlined below:

What action	Who	Where
Improvements to the current SSM methodology (new yellow book)	Jointly by Hydrologic Systems Modeling Division and Operations	Covers Lake Okeechobee Service area including LEC
Approval of the new SSM Policy	Drought Management Team & Governing Board.	
Installation of new rain gages and weather stations	Data Management and Hydrologic Systems Modeling. Immediate funding necessary.	In areas around the Lake where climate data are sparse (primarily Caloosahatchee, St. Lucie and NW part of the Lake Okeechobee Service Area

TIMING

Improvements to the current SSM methodology will be completed by August, 2001. Approval of the new SSM Policy is anticipated in September, 2001. Installation of new rain gages and weather stations will be initiated in September, 2001.

BENEFITS AND COSTS

Careful management of water storage available in the regional systems will be essential during 2001-2002 dry season if the current wet season is drier than normal and the water level in Lake Okeechobee does not rebound above 13 ft. NGVD at the beginning of October, 2001. Implementation of an improved SSM methodology will be the only means to distribute the scarce supply that may be available in the Lake in a manner that will equitably meet the needs of all users during the upcoming dry season.

The costs of this project primarily involve District staff time required to rewrite the procedures, and complete the approval process. Additional costs will be involved to purchase, install and maintain the new rain gages and weather stations.

REFERENCE

Hall, C.A. 1991. *Lake Okeechobee Supply-Side Management Plan*. Operations and Maintenance Dept., South Florida Water Management District, West Palm Beach, Fl.

6. Cancel BMP Makeup Water Deliveries During Droughts

DESCRIPTION

This option recommends that the delivery of replacement water [released to compensate for water lost due to implementation of agricultural Best Management Practices (BMPs)] from Lake Okeechobee should be discontinued during the upcoming October through February release period, as long as water levels in Lake Okeechobee are in the warning zone or lower (Hall, 1991).

On October 12, 1995, the Governing Board adopted Part II, Chapter 40E-63, F.A.C. entitled, Everglades Water Supply and Hydroperiod Improvement and Restoration. Subpart A is the BMP Replacement Water rule, which includes (a) a model to quantify annual allocation of replacement water (40E-63.223); and (b) delivery of the annual allocation of replacement water (40E-63.225). The replacement water delivered from Lake Okeechobee to the Everglades Protection Area is calculated on October 1 every year. This amount is delivered during the subsequent 5-month “release period” from October through February. Included in the rule is an exception that allows the District staff to submit a replacement delivery schedule to the Governing Board for further consideration during extreme hydrologic conditions. One such extreme condition occurs when the water level in Lake Okeechobee is at warning stage or lower, as defined in the Lake Okeechobee Water Supply Management Plan.

IMPLEMENTATION:

Steps needed to implement this option are outlined below:

What action	Who	Where
Governing Board approval for reconsideration of replacement water delivery schedule	Drought Management Team & Governing Board	Covers Everglades Agricultural Area
Discontinue replacement water delivery when water levels in Lake Okeechobee are in the warning zone*	Operations	Water Conservation Areas

* According to the BMP Makeup Water Rule, this is the warning zone as shown in Hall (1991). However, in view of the new SSM line recommended in the LEC plan, the definition of the warning zone will be revised.

TIMING

Governing Board approval for reconsideration of replacement water delivery schedule should be obtained no later than September Governing Board Meeting so that discontinuation of deliveries can begin in October.

BENEFITS

Water Resource Benefits – Potential to help alleviate high water levels in Water Conservation Areas resulting from actions related to the Cape Sable seaside sparrow biological opinion.

Water Resource Impacts – If the Water Conservation Areas need additional water during the early dry season months, discontinuing replacement water delivery may not be desirable.

Water Use Benefits – Use of this option would allow more water to be stored in Lake Okeechobee during the early dry season months for minimizing potentially severe water shortages during late dry season months (April and May 2002). The average annual replacement water amount is approximately 160,000 ac-ft. Because of the reduced rainfall during the current year, the replacement water amount is expected to be less than this average.

REFERENCES:

Hall, Alan, Lake Okeechobee Supply-Side Management Plan, Operations and Maintenance Department, South Florida Water Management District, September, 1991.

7. Water Shortage Triggers

DESCRIPTION

The concept of water shortage triggers to determine the need for imposing water shortage restrictions is based upon certain conditions or sets of conditions that indicate the potential for serious harm to occur to water resources. The potential for serious harm is usually caused by a period of rainfall deficit of varying duration and frequency that stresses water resources. This stress manifests itself through lower surface and groundwater levels, the potential for saltwater intrusion along coastal regions and negative environmental effects on fish wildlife and/or vegetation.

The water resource triggers fall into four categories based on regular monitoring and measurements of 1) water deliveries to service areas, 2) stages or water levels in Lake Okeechobee, St. Lucie and Istokpoga canals, and the Water Conservation Areas, 3) groundwater level trends, 4) salinity data from monitoring wells near public water supply wells and surface water intakes and 5) rainfall amounts and distribution that affects all four categories. There is also an interaction among the categories. For instance, increased or decreased water deliveries to service areas from the regional system may affect salinity levels in monitoring wells.

Data are compiled into two tables that present a district-wide summary of water conditions. The tables are produced weekly for the Drought Management Team. (Examples are shown in attached pages). The team makes recommendations to the Executive Director and Governing Board with respect to changes in water use restrictions based on information provided in these tables and other factors (see Figure 1, Implementation Matrix, in the Water Supply Contingency Plan), which include:

- Water Shortage Severity -- based on short/ long term climate/demand and rainfall forecasts
- Season of year
- Costs in terms of economic impacts to users and potential for irreversible adverse impacts to fish and wildlife
- Potential benefits, including consideration of the performance achieved during existing previous water restrictions
- Other factors such as MFL criteria, water quality, and implementation issues

Water resource triggers are used to scientifically evaluate the potential for serious harm to water resources and propose water use restrictions. This same concept is used to ease out of water restrictions based on the status of the resource.

IMPLEMENTATION

The Water Supply Department helps develop the triggers under the guidance of the Water

Shortage Team. The Environmental Monitoring and Assessment Department, with help of the Water Supply Department produces the weekly reports for the Drought Management Team, capturing data for the various services areas in the District. Recommendations with respect to water use restrictions are made by the Drought Management Team. Information about water use restrictions is disseminated to the public by the Office of Communications with the aid of the

Division of Public Information. Currently activities are funded by the supplemental funding provided for water shortage activities by the Governing Board. Services are provided by personnel in the Environmental Monitoring and Assessment Department and the Water Supply Department.

The actions that result from review of these reports are currently being implemented by the Drought Management Team. Recommendations on water use restrictions are made to the Executive Director by the Drought Management Team. Water shortage triggers are being monitored by the Drought Management Team at District Headquarters in West Palm Beach. Water use restrictions are applied by the District to service areas within planning regions such as the Lower East Coast. The benefits could accrue District-wide but will be specifically applicable to the service areas.




TIMING

This option is currently being implemented. Imposition of water use restrictions needs to be considered, at a minimum, when triggers indicate a potential threat of harm to the resource. Recommendations concerning changes in the restrictions need to be made to the Executive Director and the Governing Board as soon as the Drought Management Team identifies threats to water supplies or environmentally significant resources in a given service area. Failure to act in a timely manner could result in temporary or permanent harm to water resources.

BENEFITS AND COSTS

The primary benefits of this option are to a) prevent serious (irreversible or long-term) harm to regional water and environmental resources and b) provide notice to users of when restrictions may occur, so that appropriate actions can be planned. The water shortage triggers, along with the other information discussed in Section 1 above, provide key information in deciding when and where to implement water shortages and in setting the severity of the restrictions. The total monetary cost for reporting the triggers is approximately \$50K/yr plus an estimated, one-time cost for additional programming of \$30k. Other costs not captured here include those for public information, dissemination and restriction enforcement as well as costs to the water use community after restrictions are adopted.

Table A-1. Status of Water Shortage Triggers
(8/7/01)

-  Water resource triggers indicate that Phase III or Phase IV water use restrictions should be considered.
-  Water resource triggers indicate transitional conditions; water restrictions need to be considered.
-  Water resource triggers indicate that water shortage triggers have not been exceeded.

Lake Okeechobee Service Area

Yes or No	Water Shortage Trigger
Y	1. Lake levels have fallen below Lake Okeechobee Supply-Side Management Zone C?
N	2. Proposed Lake Minimum Flows and Levels criteria exceeded? (current reading = 11.16 ft. NGVD; Lake was previously below 11 ft. NGVD* for 205 days)
Y/N	3. Utilities who withdraw water from the lake for local water supply are experiencing facility constraints due to low lake levels (6 utilities have reported problems)?
N	4. Water levels are projected to drop to a point where pumping from the lake is no longer possible?
N	5. Urban water supply deliveries are currently being made from the Lake to Ag and urban service areas? (Forward pumping is underway)
N	6. Water deliveries are being made from the Lake to the STA's?
Overall Score = Red -- Water resource triggers indicate Phase III water use restrictions should continue for LOSA.	

* National Geodetic Vertical Datum

LEC Service Area-1

Yes or No	<i>Water Shortage Trigger</i>
Y	1. Lake levels have fallen below Lake Okeechobee Supply-Side Management Zone C?
N	2. Proposed Lake MFL Minimum Flows and Levels criteria exceeded?
N	3. WCA-1 administrative canal “floor” elevation of 11.34 ft. NGVD exceeded as measured at the 1-8C gage? (current reading = 16.95 ft. NGVD)
N	4. MFL depth and duration criteria exceeded for 1-7 gage (WCA-1)
<i>N</i>	5. Urban water supply deliveries are currently being made from the Lake and WCA-1 to urban service areas?
<i>Y</i>	6. Evidence of Chloride movement in LECSA-1 wells? (2 utilities have exceeded coastal groundwater saltwater intrusion criteria for Phase II – although concentrations have stabilized)
<i>N</i>	7. Water levels in area well fields are projected to drop to a point where pumps no longer function?
<i>N</i>	8. Groundwater levels are below normal or are unstable.
Overall Score = Yellow -- Water resource triggers indicate that conditions continue to improve and Phase I restrictions should be considered.	

LEC Service Area-2

Yes or No	<i>Water Shortage Trigger</i>
Y	1. Lake levels have fallen below Lake Okeechobee Supply-Side Management Zone C?
N	2. Proposed Lake Minimum Flows and Levels criteria exceeded?
N	3. Modified WCA-2A administrative canal “floor” of 10.06 ft. NGVD exceeded as measured at S11B? (current reading = 12.43 ft)
N	4. Proposed MFL depth and duration criteria exceeded for WCA-2B (2-99 gage)?
<i>N</i>	5. Urban water supply deliveries currently made from WCA-2A to urban service areas? (Local groundwater supplies are currently meeting utility demands).
<i>N</i>	6. Evidence of chloride movement in LECSA-2 wells? (at present no public water supply utilities have exceeded Phase II saltwater intrusion criteria).
<i>N</i>	7. Water levels in area well fields are projected to drop to a point where pumps no longer function?
<i>N</i>	8. Groundwater levels are below normal or are unstable.
Overall Score = Yellow -- Water resource triggers indicate that conditions continue to improve and Phase I restrictions should be considered.	

LEC Service Area-3

Yes or No	<i>Water Shortage Trigger</i>
Y	1. Lake levels have fallen below Lake Okeechobee Supply-Side Management Zone C?
N	2. Proposed Lake MFL water depth and duration criteria exceeded
N	3. WCA-3 canal “floor” of 7.50 ft. NGVD exceeded as measured at S-333? (current reading = 9.73 ft NGVD)
Y & N	4. Proposed MFL depth and duration criteria exceeded for WCA-3A (No), WCA-3B (No) and ENP (yes) gages?
N	5. Urban water supply deliveries currently being made from the WCA-3A to urban service areas (South Dade Conveyance System and Cape Sable Seaside Sparrow)?
N	6. Evidence of chloride movement in LECSA-3 wells? (at present no public water supply utilities have exceeded Phase II saltwater intrusion criteria)
N	7. Water levels in area well fields are projected to drop to a point where pumps no longer function?
Y	8. Groundwater levels are below normal or are unstable. (Water levels are increasing due to recent rainfall. In general, they are above normal along the coast and below normal inland).
Overall Score = Yellow -- Water resource triggers indicate that conditions continue to improve and Phase I restrictions should be considered.	

North Palm Beach County Service Area

Yes or No	Water Shortage Trigger
N	1. Water level in well PB-565 below average or unstable? (current reading = 6.19 ft NGVD)
N	2. Water level in well PB-689 below average or unstable? (current reading = 25.11 ft NGVD)
N	3. WPB Water Catchment Area Nature Center gauge reading below 17.5 ft NGVD for more than 90 days. (current reading 19.39 NGVD)
N	4. PC13 gauge in the Loxahatchee Slough is below 15 ft NGVD. (current reading 18.26 NGVD)
N	5. Zero flow over C18 weir?
N	6. Zero flow at G92?
N	7. Flow over Lainhart Dam is less than 65 cfs (Interim NPB Comp. Plan target)?
Overall Score = Green – Water resource triggers indicate that conditions are normal and that restrictions may not be necessary.	

Upper East Coast Service Area

Yes or No	Water Shortage Trigger
N	1. Water level in the C-23 canal is below the operational minimum water level (14.00 ft NGVD) as measured at S97_H (current reading = 20.79 ft NGVD).
N	2. Water level in the C-24 canal is below the operational minimum water level (14.00 ft NGVD) as measured at S49_H (current reading = 18.91 ft NGVD)?
N	3. Water level in the C-25 canal is below the operational minimum water level (14.00 ft NGVD) as measured at S99_H (current reading = 18.62 ft NGVD).
N	4. Groundwater levels are below normal or are unstable.
Overall Score = Green – Water resource triggers indicate that conditions are normal and that restrictions may not be necessary.	

Caloosahatchee Utilities

Yes or No	Water Shortage Trigger
N	1. Chloride concentrations at public water supply intakes in the Caloosahatchee River exceed the criteria for surface water sources.
Overall Score = Yellow -- Water resource triggers indicate that conditions continue to improve and Phase I restrictions should be considered.	

Lower West Coast Service Area

Yes or No	Water Shortage Trigger
N	1. Groundwater levels are below normal or are unstable. (Water levels are increasing due to recent rainfall).
Overall Score = Green -- Water resource triggers indicate that conditions are normal and restrictions may not be necessary	

Orange County

Yes or No	Water Shortage Trigger
Y	1. Groundwater levels are below normal or are unstable.
Overall Score = Yellow -- Water resource triggers indicate that conditions are transitional and that Phase II restrictions should be continued.	

Indian Prairie

Yes or No	Water Shortage Trigger
N	1. Water level in the C-40 canal is below the operational minimum water level (17.70 ft NGVD) as measured at S72_H? (current reading = 19.43 ft NGVD)
N	2. Water level in the C-41 canal is below the operational minimum water level (17.00 ft NGVD) as measured at S71_H? (current reading = 19.54 ft NGVD)
N	3. Water level in the C-41A canal is below the operational minimum water level (29.00 ft NGVD) as measured at S83_H ? (current reading = 31.94 ft NGVD)
N	4. Pumping at G207 and G208 prevented by Lake Okeechobee water levels less than 10.00 ft NGVD.
Overall Score = Green – Water resource triggers indicate that conditions are normal and that restrictions may not be necessary.	

**Table A- 2. Status of Phase III Water Use Restriction
Recommendations by Service Area.**

August 7, 2001



Water resource triggers indicate that water shortage triggers have not been exceeded.







Water resource triggers indicate that conditions are transitional and that restrictions may be considered in the near future.








Water resource triggers indicate that Phase III water restrictions should be considered for this area.


PHASE III WATER SHORTAGE “TRIGGERS”	SUMMARY OF CURRENT CONDITIONS	Implication	Status
Lake Okeechobee			
<ul style="list-style-type: none"> Lake Okeechobee under Supply-Side Management (SSM) (Phase III) <u>Minimum Flow Levels (MFL)</u>: Water levels should not fall below 11.0 ft >80 days, once every 6 years 	<ul style="list-style-type: none"> The lake is currently under Phase III Supply Side Management which started the week of 11/27/00 Lake at 11.196ft NGVD. Lake stages was below 11 ft for 205 days 	L.O. Supply-side Management and MFL level and duration criteria have been exceeded, however return frequency criteria have not. Water was pumped into the Lake at S2 and S3 during the past week.	
<ul style="list-style-type: none"> <u>Surface Pump Yield</u>: (a) Water levels at utility surface water intakes drop sufficiently to impact pump performance (Phase I & II), (b)) Water levels at utility surface water intakes drop sufficiently that pumping is no longer possible (Phase III) 	<p>Six utilities that withdraw water directly from Lake Okeechobee are experiencing facility constraints due to the falling lake level:</p> <ul style="list-style-type: none"> South Bay Belle Glade Okeechobee Pahokee Bryant Clewiston 	District staff is pursuing facility upgrades to these facilities that would allow them to withdraw water safely at much lower lake levels. Belle Glade, Pahokee and Okeechobee utilities have experienced intake problems intermittently. Temporary pumps are supplying Pahokee treatment plant until the intake modification construction is complete. The same is true for Belle Glade with the exception that one of their normal supply pumps is available. Standby pumps are in place at Okeechobee as they have experienced vortex formation at their intake.	




PHASE III WATER SHORTAGE “TRIGGERS”	SUMMARY OF CURRENT CONDITIONS	Implication	Status
Lower East Coast – Service Area 1			
<ul style="list-style-type: none"> <u>Lake Okeechobee</u> (the backup water supply for the LEC Service Area 1) is below Supply-Side Management Zone C 	<ul style="list-style-type: none"> The lake is currently at 11.16 ft. NGVD and is below SSM Zone C indicating that Phase III water shortage restrictions may be necessary to conserve regional water supplies. 	The lake is the primary backup water supply for LECSA-1, 2 and 3.	
<ul style="list-style-type: none"> <u>WCA-1 “Floor” Elevation</u>: Water levels should not fall below 11.0 ft NGVD in the borrow canal (1-8C gage) below this elevation no further release of water is permitted unless an equal volume is provided to WCA-1 by another source 	<ul style="list-style-type: none"> Water levels currently 5.61 ft. above the administrative minimum canal floor elevation of 11.34 ft. (Today's reading = 16.95 ft NGVD) 	Water level conditions within the canal are above the administrative floor elevation of 11.00 ft NGVD.	
<ul style="list-style-type: none"> <u>Proposed MFL Criteria for WCA-1 Peat – Forming Wetlands</u>: Water levels within peat-forming wetlands shall not fall 1 foot or more below ground surface as measured at key gages, for one or more days during a period in which the water level has remained below ground for a minimum of 30 days at specified return frequencies identified for that gage. 	<ul style="list-style-type: none"> WCA-1 (interior marsh 1-7 gage): At present there are no exceedances of MFL criteria within WCA-1. Today's reading of 16.90 ft. NGVD at the 1-7 gage is 1.50 ft. above ground. 	The 1-7 gage remains above the trigger elevation, however peripheral areas of the marsh may fall well below this level as the interior borrow canal is drawn down for water supply deliveries.	




PHASE III WATER SHORTAGE “TRIGGERS”	SUMMARY OF CURRENT CONDITIONS	Implication	Status
Lower East Coast – Service Area 1 - continued			
<ul style="list-style-type: none"> • <u>Magnitude of Chloride Movement</u>: Saline water moves inland to the degree that a coastal wellfield must curtail their use to avoid induction of saline water into production wells (Phase III) • <u>Well Field Yield</u>: (a) Water levels are projected to drop to point that pumping is constrained (Phase I & II), (b) Water levels are projected to drop to a point where pumps no longer function (Phase III). • <u>General Groundwater Conditions</u>: Water levels in wells in this service area are below average and reliable use of the water supply is threatened 	<ul style="list-style-type: none"> • Two LEC SA1 utilities have exceeded the coastal groundwater saltwater intrusion criteria for phase II water restrictions. Chloride levels have stabilized. • City of Lake Worth • Town of Lantana • Surficial Aquifer System: water levels in the seven real time monitor wells rose over the past month and are above normal. 	<p>Phase II restrictions do not require reduction to permitted water use, but do trigger the following response:</p> <ul style="list-style-type: none"> • Weekly monitoring of all wells • Testing of interconnects with adjacent utilities <p>Implementation of mutually agreed upon operational plan to minimize the potential for further movement of the saltwater front.</p>	



PHASE III WATER SHORTAGE “TRIGGERS”	SUMMARY OF CURRENT CONDITIONS	Implication	Status
Lower East Coast – Service Area 2			
<ul style="list-style-type: none"> • <u>WCA-2A “Floor” Elevation</u>: Water levels should not fall below 10.00 ft. NGVD in the L-35B canal (S-11B), below this elevation no further release of water is permitted unless an equal volume is provided to WCA-2 by another source. 	<ul style="list-style-type: none"> • Water level is 12.43 ft NGVD. This value currently exceeds the “administrative floor elevation” schedule (10.06 ft. NGVD) 	No deliveries are currently being made from WCA-2 to LESCA-2.	
<ul style="list-style-type: none"> • <u>Proposed MFL Criteria for WCA-2 Peat-Forming Wetlands</u>: Water levels within peat-forming wetlands shall not fall 1 foot or more below ground surface as measured at key gages, for one or more days during a period in which the water level has remained below ground for a minimum of 30 days at specified return frequencies identified for that gage. 	<ul style="list-style-type: none"> • <u>WCA-2A (GA-111 gage)</u>: Water levels are 2.13 ft. above ground. No exceedence of MFL criteria. • <u>WCA-2B (GA-99 gage)</u>: Water levels are 3.16 ft. above ground. No exceedence of MFL criteria. 	MFLs have not been violated in either WCA-2A or WCA-2B.	
<ul style="list-style-type: none"> • <u>Magnitude of Chloride Movement</u>: Saline water moves inland to the degree that a coastal wellfield must curtail their use to avoid induction of saline water into production wells (Phase III) • <u>Well Field Yield</u>: (a) Water levels are projected to drop to point that pumping is constrained (Phase I & II), (b) Water levels are projected to drop to a point where pumps no longer function (Phase III). • <u>General Groundwater Conditions</u>: Water levels in wells in this service area are below average and reliable use of the water supply is threatened 	<ul style="list-style-type: none"> • At present there are no Public Water Supply Utilities in LEC-SA2 that have exceeded Phase II saltwater intrusion criteria. • <u>Biscayne Aquifer System</u>: water levels rose by an average of 1.28 ft in Broward County the past week. They are above normal for this time of year. 	Monitoring of Phase II criteria continues.	


PHASE III WATER SHORTAGE “TRIGGERS”	SUMMARY OF CURRENT CONDITIONS	Implication	Status
Lower East Coast – Service Area 3			
<ul style="list-style-type: none"> WCA-3 “Floor” Elevation: Water levels should not fall below 7.50 ft NGVD in the L-67 canal (at S-333), below this elevation no further release of water is permitted unless an equal volume is provided to WCA-3 by another source. 	<ul style="list-style-type: none"> Water levels do not currently exceed the minimum floor criteria. (current reading = 9.73 ft NGVD) 	Availability of providing additional water to the LECSA-3 from WCA-3A is limited. Staff will track these changes.	
<ul style="list-style-type: none"> <u>Proposed MFL Criteria for WCA-3 Peat – Forming Wetlands</u>: Water levels within peat-forming wetlands shall not fall 1 foot or more below ground surface as measured at key gages, for one or more days during a period in which the water level has remained below ground for a minimum of 30 days at specified return frequencies identified for that gage. <u>Proposed MFL Criteria for WCA-3 Marl – Forming Wetlands</u>: Water levels within marl-forming wetlands shall not fall 1.5 feet or more below ground surface as measured at key gages, for one or more days during a period in which the water level has remained below ground for a minimum of 90 days at specified return frequencies identified for that gage. 	<ul style="list-style-type: none"> <u>Southern WCA-3A</u> (Gages 3A-4 and 3A-28) These sites are wet, no exceedance of MFL criteria <u>WCA-3B (3BS1W1 gage)</u> Water levels are 1.14 ft. above ground. MFL water depth criteria had been exceeded at this site for 168 days. <u>NE Shark Slough</u> (ENP): Minimum water depth criteria at NESRS-2 was exceeded (6.68 ft. NGVD). Water levels are 1.06 ft. above ground. <u>Rocky Glades</u> (ENP): Water levels at G-3273 are currently 0.26 ft. below ground and have been below ground for 282 days. MFL depth and duration criteria have been exceeded. 	<p>There is water within the southern portion of WCA-3A. Some of this water may be available for water deliveries to the urban service area, however this may impact water dependent wildlife in these areas. Southern WCA-3A may represent an area of “last refuge” for Everglades wildlife.</p> <p>Low water levels reported for the Rocky Glades are the result of overdrainage caused by the operation of L31N and are not the direct result of a water supply withdrawal. These low stages are typical for this area under very dry conditions.</p>	

PHASE III WATER SHORTAGE “TRIGGERS”	SUMMARY OF CURRENT CONDITIONS	Implication	Status
Lower East Coast – Service Area 3 – continued			
<ul style="list-style-type: none"> • <u>Magnitude of Chloride Movement</u>: Saline water moves inland to the degree that a coastal wellfield must curtail their use to avoid induction of saline water into production wells (Phase III) • <u>Well field Yield</u>: (a) Water levels are projected to drop to point that pumping is constrained (Phase I & II), (b) Water levels are projected to drop to a point where pumps no longer function (Phase III). • <u>General Groundwater Conditions</u>: Water levels in wells in this service area are below average and reliable use of the water supply is threatened. 	<ul style="list-style-type: none"> • At present there are no Public Water Supply Utilities in LEC-SA2 that have exceeded Phase II saltwater intrusion criteria. • Biscayne Aquifer System: water levels rose by an average of 0.62 ft in Miami-Dade County the past week. Water levels are generally below normal for this time of year. 	Monitoring of Phase II criteria continues.	

PHASE III WATER SHORTAGE “TRIGGERS”	SUMMARY OF CURRENT CONDITIONS	Implication	Status
Lower East Coast – North Palm Beach County Service Area			
<ul style="list-style-type: none"> <u>Marsh Levels</u>: Surface water in natural areas should not fall below the level where they could cause damage to the resource. 	<ul style="list-style-type: none"> Marsh water levels are above ground in the Loxahatchee Slough (PC13 gauge, average ground elevation 16.5 NGVD) and the West Palm Beach Water Catchment Area (nature center gauge, average ground elevation 17.5 NGVD) 	Consider reducing or removing water use restrictions.	
<ul style="list-style-type: none"> <u>Surficial aquifer water levels</u>: Water levels are substantially below normal levels and threaten water supply in the region. 	<ul style="list-style-type: none"> Water level in well PB-565 is 6.19 ft NGVD, which is average for this time of year. Water level in well PB-689 is 25.11 ft NGVD, which is average for this time of year. 	Consider reducing or removing water use restrictions.	
<ul style="list-style-type: none"> <u>Flow in canals and from impoundments</u>: Flow is below proposed minimum values. 	<ul style="list-style-type: none"> Flow at C18 weir Flow at G92 Flow over Lainhart Dam (65 cfs or greater) 	Currently meet or exceed proposed minimum values	

PHASE III WATER SHORTAGE "TRIGGERS"	SUMMARY OF CURRENT CONDITIONS	Implication	Status
Upper East Coast Service Area			
<ul style="list-style-type: none"> Canal Water Levels: Water levels in canals are below minimum levels. 	<ul style="list-style-type: none"> C-23 canal at S97_H is 20.79 ft NGVD; minimum water level of 14.00 ft NGVD. C-24 canal at S49_H is 18.91; minimum water level is 14.00 ft NGVD. C-25 canal at S99_H is 18.62 ft NGVD; minimum water level of 14.00 ft NGVD. 	Consider reducing or removing water use restrictions.	
<ul style="list-style-type: none"> General Groundwater Conditions: Water levels in wells in this service area are below average and reliable use of the water supply is threatened. 	<ul style="list-style-type: none"> Water levels in the coastal wells are above normal. 	Consider reducing or removing water use restrictions.	
Caloosahatchee Utilities			
<ul style="list-style-type: none"> <u>Magnitude of Chloride Movement</u>: Saline water moves inland to the degree that a coastal wellfield must curtail their use to avoid induction of saline water into production wells (Phase III) 	<ul style="list-style-type: none"> Chloride concentrations in the Caloosahatchee River were 40 mg/l as of 7/31/01 and meet state drinking water standards. Water cannot be released from the Lake to flush out the salt. <p>This impacts the following utilities:</p> <ul style="list-style-type: none"> Lee County Utilities (north service area) 	<p>Phase II restrictions do not require reduction to permitted water use, but do trigger the following response:</p> <ul style="list-style-type: none"> Weekly monitoring of all wells Testing of interconnects with adjacent utilities Implementation of mutually agreed upon operational plan to minimize the potential for further movement of the saltwater front. <p>Reduced lockages (from 10/day to 7/day) on the Caloosahatchee has restricted navigation</p>	

PHASE III WATER SHORTAGE "TRIGGERS"	SUMMARY OF CURRENT CONDITIONS	Implication	Status
Lower West Coast Service Area			
<ul style="list-style-type: none"> • <u>Magnitude of Chloride Movement</u>: Saline water moves inland to the degree that a coastal wellfield must curtail their use to avoid induction of saline water into production wells (Phase III) • <u>Well field Yield</u>: (a) Water levels are projected to drop to point that pumping is constrained (Phase I & II), (b) Water levels are projected to drop to a point where pumps no longer function (Phase III). 	<ul style="list-style-type: none"> • At present there are no Public Water Supply Utilities in the LWC that have exceeded Phase II saltwater intrusion criteria. 	Monitoring of Phase II criteria continues.	
<ul style="list-style-type: none"> • <u>General Groundwater Conditions</u>: Water levels in wells in this service area are below average and reliable use of the water supply is threatened. 	<ul style="list-style-type: none"> • <u>Surficial Aquifer System</u>: water levels in the seven real time monitor wells rose by an average of 0.50 ft in the past week. Water levels are above normal. • <u>Lower Tamiami</u>: water levels in the seven Lower Tamiami monitor wells continued to rise over the past week. The water levels in these wells rose by an average of 0.79 feet. Water levels are above average. • <u>Mid-Hawthorn Aquifer</u>: Water levels in the seven Mid Hawthorn Aquifer real time monitor wells rose by an average of 1.66 feet during the past week. One inland well is below average for this time of year. • <u>Sandstone Aquifer</u>: Water levels in the nine sandstone aquifer wells rose by an average of 1.09 feet during the past week. 	Groundwater levels rising in response to recent rainfall but still generally below average.	

<i>PHASE III WATER SHORTAGE “TRIGGERS”</i>	<i>SUMMARY OF CURRENT CONDITIONS</i>	<i>Implication</i>	<i>Status</i>
Orange County			
<ul style="list-style-type: none">• <u>General Groundwater Conditions</u>: Water levels in wells in this service area are below average and reliable use of the water supply is threatened.	Water levels in the wells are rising but are below normal.	Continue monitoring under Phase II restrictions. Take lead from SJRWMD w.r.t. changes in restrictions.	

8. Minimize Deliveries to Maintain LEC Canal Levels

DESCRIPTION

This option consists of temporarily lowering maintenance levels upstream of select coastal salinity control structures as a means to reduce the amount of water that has to be released from regional storage into coastal canals to compensate for seepage losses to tide. Lowering coastal canal stages for short periods of time can save significant volumes of surface water in the regional system. This option focuses on C&SF canals located in coastal Palm Beach, Broward and Miami-Dade counties. The revised maintenance elevations and affected structures are described in “-----“, SFWMD, 2001 and range between 0.2 feet below normal levels in Miami-Dade County to more than 1.5 feet in Palm Beach County. The significant risk associated with this option is coastal saltwater intrusion. Higher canal stages maintain higher groundwater elevations needed to offset the landward movement of denser saline water. Movement of the coastal saltwater interface in relation to short-term declines in fresh groundwater levels is very slow. However, the District has not operated the coastal canals at the proposed elevations before. Further, no saline interface models have evaluated the potential risk of this option. Best professional judgement suggests two months of the modified maintenance levels as proposed for Urban Service Areas 2 and 3 and three months of the proposed levels in Urban Service Area 1 should present a low risk of significant saline intrusion. Higher risks and uncertainties are associated with longer duration of reduced levels. Further study of the dynamics of canal stage and coastal saltwater movement should be pursued.

IMPLEMENTATION

The Operations is responsible for implementing this option. However, since this option involves a deviation from normal operations and includes risks to groundwater resources, the Executive Office and possibly the Governing Board should be involved in the decision to implement. In addition, local governments and affected public water supply utilities and diversion and impoundment permit holders should be involved.

Because this deviation in operations of the C&SF project is fully tied to water supply, the Corps of Engineers will not request to review and authorize this revised schedule. The decision to implement this option will rest with the District. This option should only be used in those areas where significant benefits (and low risks) are likely to occur. For example, if water levels in WCA-3 fall below the floor but levels in WCA-1 remain above the floor, revised coastal canal maintenance levels may be applied to Urban Service Area 3 but not in Urban Service Area 1.

TIMING

Implementation of this option can be done immediately when needed based on the availability of regional water supply. If implementation is delayed and the normal coastal canal stages are maintained by water supply deliveries from the Lake, serious impacts to the Lake’s ecosystem may occur as the proposed MFL criteria for Lake Okeechobee will be exceeded for two dry seasons in a row.. In addition, significant impacts to portions of the LOSA may occur if the forward pumps do not have the capacity to meet both urban and agricultural demands.

It is proposed that implementation of this option should be postponed until such time that the WCAs are below their floor elevations and forward pumps are required to move water to the

coastal areas. Under such conditions, the forward pumps may not have sufficient capacity to maintain normal coastal canal levels anyhow. To minimize the duration of low levels, implementation of this option should be delayed until late in the dry season, occur only after other options have proven to be ineffective

BENEFITS AND COSTS

The potential water supply savings associated with this option are significant. During the LEC water supply planning process, research demonstrated that a small change (approximately 0.2 ft.) in coastal canal stages in Miami Dade County alone saved 40,000 acre feet of regional water during the average dry season. Better estimates of the water supply savings can be made, based on actual conditions, should this option become imminent.

The benefits of the reduction in water deliveries to the coast will accrue to the WCAs and the Lake, since both of these areas will be under extreme stress if the hydrologic conditions exist that would trigger the deployment of this option.

The costs associated with this option are uncertain, but could range from very small (the cost of reduced operation of gates and pumps otherwise needed to maintain higher levels during drought) to catastrophic (should coastal wellfields become inundated by saltwater). The utilities most at risk include 18 wellfields located along the coast. These utilities serve a total of approximately 0.5 million people. It is highly unlikely that saltwater intrusion would occur to the extent that these utilities would be rendered unusable. However, some of the wells could be affected should the lower canal levels persist for too long.

9. Diversion and Impoundment Operations

DESCRIPTION

This option deals with the temporary reduction of regional water deliveries authorized to diversion and impoundment (D/I) permittees in urban Palm Beach and Broward counties. Urban D/I systems are authorized by a water use permit to withdraw water from the regional system to maintain water levels in secondary canals for water supply and aquifer recharge purposes. Under District water shortage rules (40E-21 F.A.C.), water withdrawals by D/Is are voluntarily reduced. Due to the areas involved and the large water losses that occur during dry conditions, D/I systems use large volumes of water to maintain canal and lake systems inland.

Groundwater modeling conducted during the 2001 drought showed that significant reductions in water use by the D/I lowered inland surface and groundwater levels, but the critical coastal groundwater levels did not change significantly. As a result, the Governing Board issued an order requiring the urban D/Is to reduce their use by at least 50% of their permitted maximum month allocation. Actual cutbacks were closer to 70-75% of the maximum monthly allocation. This resulted in significant reductions in the withdrawals from WCA-1, WCA-2 and Lake Okeechobee.

IMPLEMENTATION

This option is implemented by 6 individual D/I permittees under District water shortage order 2001-48 DAO-WS. The affected permittees are located in Palm Beach and Broward counties.

TIMING

This order is currently in effect, so no additional actions are required of the District except for monitoring and compliance review. The Water Use Division conducts the monitoring of the water use of the affected D/Is on a weekly basis. This option should be implemented as long as the modified Phase II restrictions are in effort.

BENEFITS AND COSTS

The primary benefit of this option is the reduction in withdrawals from WCA 1 and 2 and potentially, the Lake. The total maximum monthly allocation for all 6 of the affected D/I permits combined is 13,544 mgd. A 50% reduction in this demand is 6,772 mgd. Based on actual performance during the last dry season (approx. 70% reduction) the water savings could be as much as 4,063 mgd below the maximum permissible amount.

Benefits occur to the ecosystem of the WCAs and the Lake as well as reserve water supply for water users, if necessary. The costs are low for the permittees in that the pumping is reduced. However, as the urban water levels drop inland, complaints occur. In Palm Beach County, certain inland canal minimum elevations are critical to agricultural interests who have limited withdrawal capabilities. If water levels become too low, these users would have no water supply and significant economic losses.

10. Southern Lake Istokpoga Basin Operations

DESCRIPTION

The purpose of this option is to supply the Seminole Tribe's Brighton Reservation (Reservation) with water per Agreement C-4121. This Agreement establishes canal levels for the basin and monthly water deliveries from Lake Okeechobee and Lake Istokpoga. The primary Reservation inflows are located along the C-40 and C-41 canals. The District delivers water to the Reservation from Lake Istokpoga, or by backpumping Lake Okeechobee water through G-207 and G-208 via these canals. An addition to the Reservation, other permitted users in the southern portion of the basin may benefit from this option. These permitted users also withdraw surface water from the C-40 and C-41 canals south of S-70 and S-75, as well as other District canals, L-59, L-60, and L-61, which are connected to the C-40 and C-41.

Agreement C-4121 establishes the operational strategy for G-207 and G-208 during water shortage conditions. Based on the Water Rights Compact, the Tribe is entitled to 15% of the total amount of water that can be withdrawn from the District canals and from the District borrow canals by all users from surface water within the Lake Istokpoga-Indian Prairie Basin. . Lake Istokpoga water availability estimates for the Reservation, based on the 15% figure, are 26,872 acre-feet during the wet season (June through October) and 16,997 acre-feet during the dry season (November through May). If water is not available from Lake Istokpoga because stages are below the regulation schedule, then G-207 and G-208 will be used to provide water to the Brighton Reservation from Lake Okeechobee, based on the Lake Okeechobee Supply Side Management criteria.

During the 2000 to 2001 dry season, these pumps were successfully operated to supply water to the Brighton Reservation; however, once Lake Okeechobee levels dropped to below 9.2 feet NGVD, Lake bottom was exposed, which essentially prevented Lake water from flowing into the C-40 and C-41 canals. This condition severely affected the District's ability to pump G-207 and G-208. A strategy to correct this physical limitation is discussed as Option 21 in this Plan.

IMPLEMENTATION

This option can be implemented based on criteria in Agreement C-4121. Specific criteria included in this Agreement regarding entitled water deliveries to the Reservation are established for the following conditions: 1) No declared water shortage, 2) Declared water shortage in Lake Istokpoga, and 3) Declared water shortage in Lake Okeechobee. All facilities required to release water from Lake Istokpoga, or pump water into the southern basin from Lake Okeechobee are operational. The Office of Counsel and Water Use Regulation are responsible for interpreting the Compact Agreement and developing operational protocols. The Operations Division will implement this option, with assistance from other departments and divisions. Operational protocols established during this year's water shortage would provide a base for future water shortage operational plans implemented in this area.

TIMING

Under the current Lake Istokpoga regulation schedule, regional water shortages can be declared under 40E-221 when stages in Lake Istokpoga are below 38.0 feet in August, 39.0 feet in October, and 38.5 feet in December.

BENEFITS AND COSTS

The District will be capable of providing water deliveries required by Agreement C-4121 to the Brighton Reservation by pumping water from Lake Okeechobee using G-207 and G-208 via the C-41 and C-40 canals. Furthermore, other permitted surface water users in the southern portion of the Lake Istokpoga-Indian Prairie Basins will also benefit by operation of these pumping stations.

Both G-207 and G-208 are rated to pump 135 cfs. Estimated operational cost for the each pump is \$130/hour. From December 12, 2000 through July 3, 2001, these pumps operated approximately 370 hours and pumped 4,121 ac-ft of water to the reservation and southern portions of the basin. Anticipating similar operations for the upcoming 2001 – 2002 dry season, the cost to implement this option is approximately \$48,100.

11. Stormwater Treatment Area (STA) Drought Operations

DESCRIPTION

For optimal phosphorus removal performance, the normal operating depths for the STAs range between 0.5 ft and 4.5 ft, with an average of approximately 1.5 ft. For drought operations, instead of delivering supplemental water to keep the entire acreage of the STAs at a minimum of 6 inches, some treatment cells within the STAs can be operated at lower depths, thus sacrificing performance, but sharing adversity with other water users. Depending on the vegetation, a Mortality Threshold can be established for each treatment cell within the STAs. This Mortality Threshold represents the lowest depth necessary to sustain the viability of the vegetation. For cattail-dominated cells, this Mortality Threshold is approximately 6 inches below ground; for cells dominated by submerged aquatic vegetation this Mortality Threshold is approximately 6 inches above ground; and for sawgrass-dominated cells, there is no threshold, i.e., there is no need to add any supplemental water to the cell. This approach allows the STAs to share the adversity and allows us to prioritize water deliveries to those treatment cells that absolutely need the supplemental water.

IMPLEMENTATION

The existing protocol for this option is described in the attachment. Everglades Construction Project (ECP) and operations staff monitor STA water depths every day, and ECP staff make monthly projections of supplemental water needs. Through a coordinated effort, supplemental water deliveries are requested by ECP staff from the Drought Contingency Board, and if approved, Operations staff deliver the needed water to the STAs. Existing STA operations funds are used for these supplemental water deliveries.

Outstanding issues concerning this option include the need for continued research and refinement of the Mortality Thresholds, and pursuit of reservations of water rights (or alternatively, allocations) of water needed for the STAs. ECP and Watershed Management staff are researching the Mortality Thresholds, and ECP and other District staff are pursuing the water rights/allocation issue.

TIMING

This option was successfully implemented at all of the STAs during the present drought and can be refined over time. There is no reduction in potential benefits if implementation of this option is reduced or delayed.

BENEFITS AND COSTS

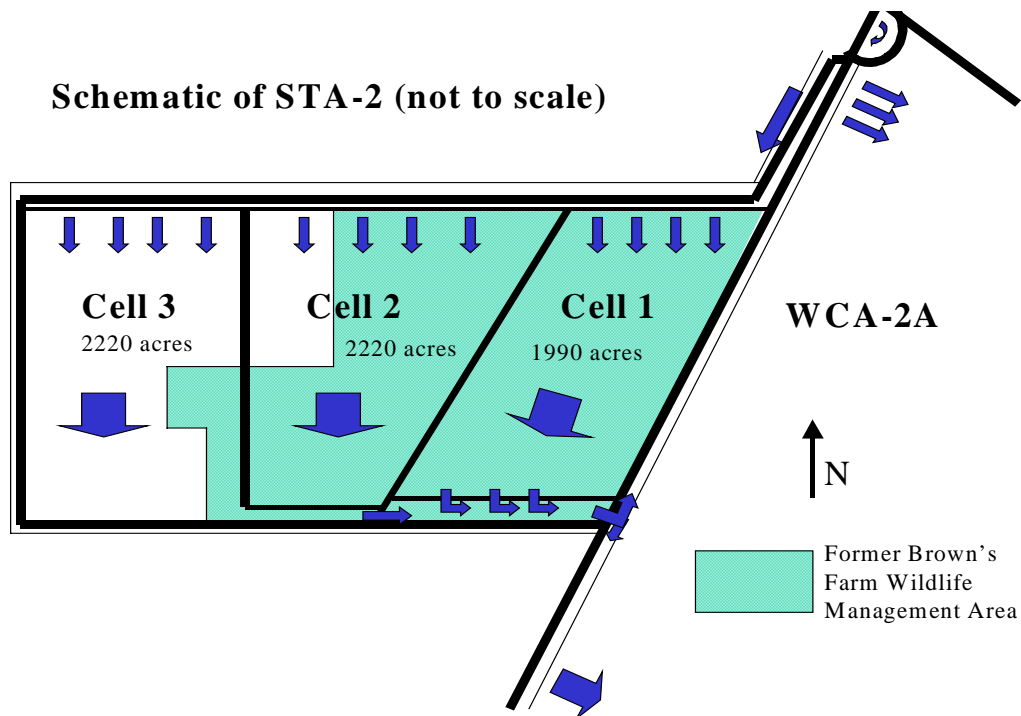
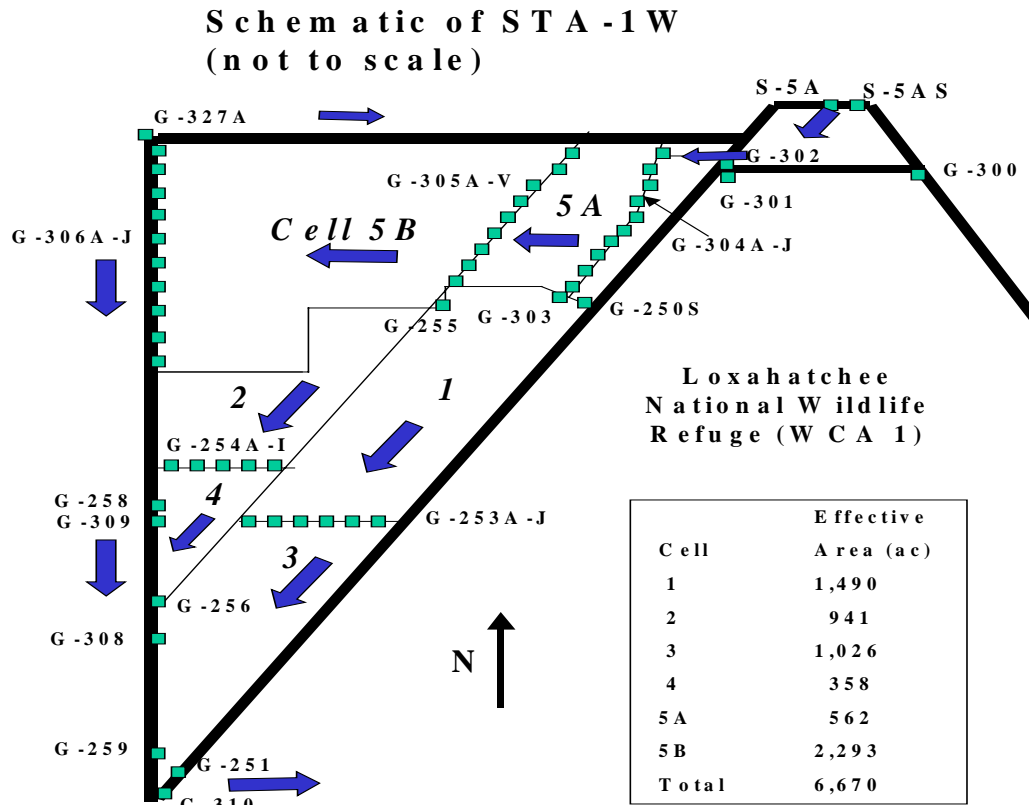
Benefits accrue to all water users within the Lake Okeechobee water use region. Operating the STAs in this manner reduced the supplemental water deliveries to the STAs by approximately 35,000 acre feet compared to delivering water to maintain a minimum of 6 inches over the entire acreage of the STAs. The cost of this option is negative, since a net cost savings was realized due to the need to make less supplemental water deliveries.

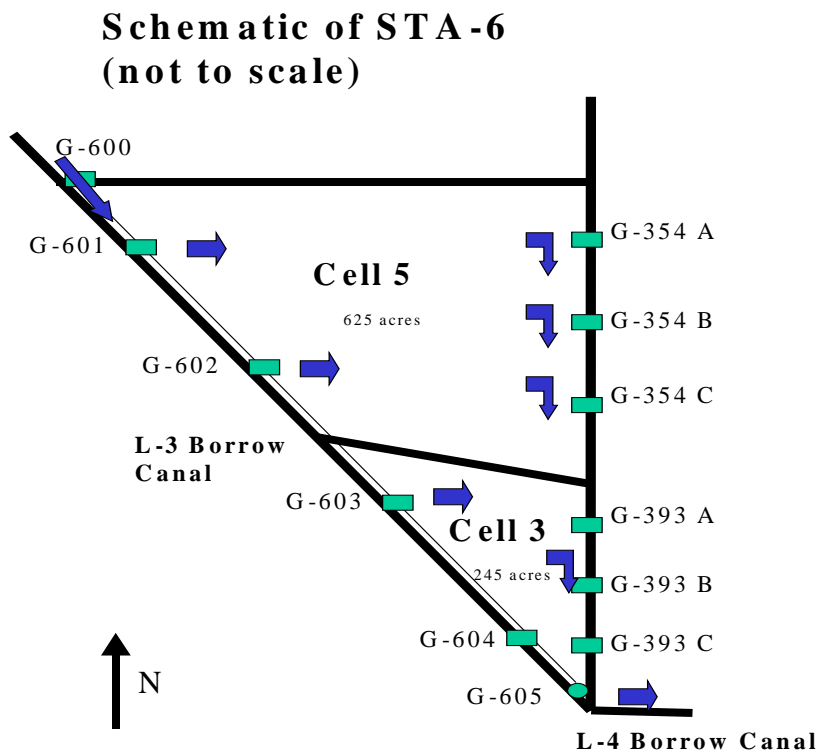
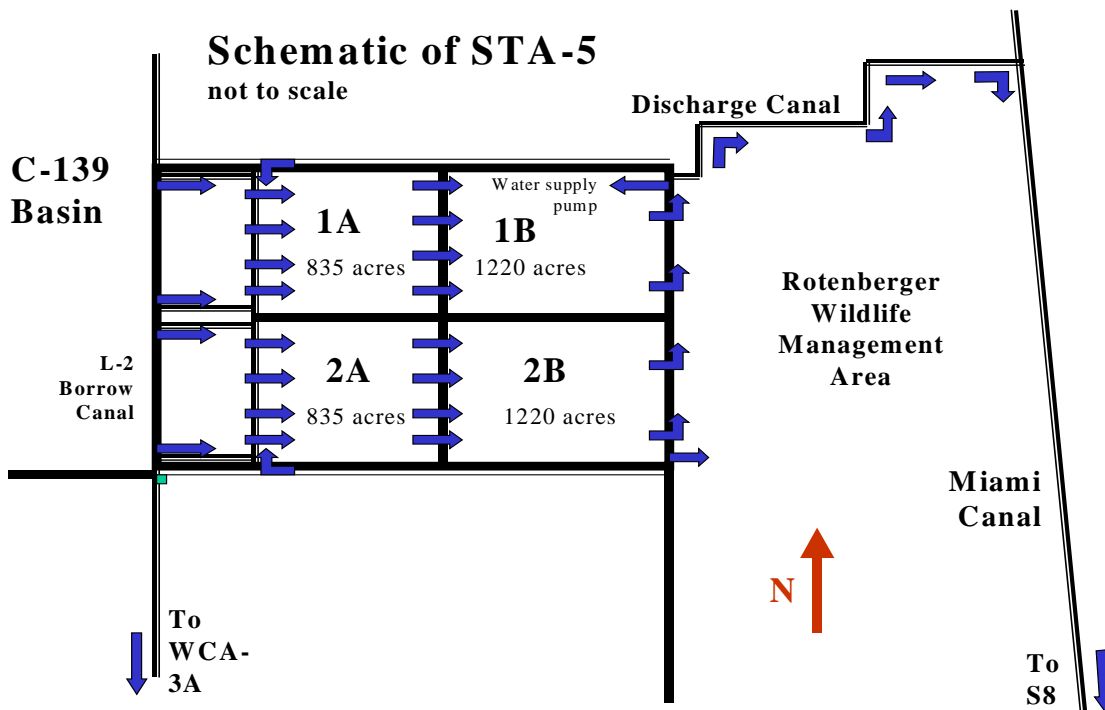
PROTOCOL FOR SUPPLEMENTAL WATER DELIVERIES TO THE STAS

- Water levels, structure openings, and estimates of flow in each cell in the Stormwater Treatment Areas (STAs) are monitored by ECP staff each weekday, and monitored every day by Operations staff. Daily hydraulic data sheets are prepared (see attached).
- From the daily values, ECP staff make monthly projections of the volume of supplemental water needed within the STAs to keep water depths from dropping below the Mortality Threshold, defined as the depth below which the vegetation in a treatment cell begins to die. For submerged aquatic vegetation (SAV) this threshold is estimated as 6 inches; for cattail, the threshold is estimated as 6 inches below ground; for sawgrass, there is no threshold and water levels can drop several feet below ground. Each STA has a mixture of vegetation within each of the treatment cells and hence, there are different Mortality Thresholds within a single STA.
- When supplemental water deliveries are needed, ECP staff requests deliveries through the District's Drought Management Team. Alternatives are evaluated, including shunting water within the STAs, modifying operating criteria of seepage return pumps, and prioritizing treatment cells among the STAs.
- Beginning in March 2001, the Governing Board has been kept apprised of projected deliveries for the STAs. In March District staff apprised the Governing Board that approximately 12,000 acre feet of supplemental water would be needed for the STAs through May to maintain depths at or above the Mortality Threshold.
- Due to rainfall during the end of March, no deliveries were requested for April, and the request for May was significantly less than presented to the Governing Board in March. On May 4, ECP staff requested 830 acre feet for STA-1W Cell 5 (an SAV cell), 1,130 acre feet for STA-2 Cell 3 (an SAV cell), and 810 acre feet for STA-5 Cell 1B (an SAV cell), for a total of 2,770 acre feet. This is 2,038 acre feet less than anticipated in March. For the period March through May, District staff requested approximately 6,000 acre feet less than projected in March.
- In general, it is desired to deliver the monthly allocation of water in a single allotment, which may temporarily raise depths above the Mortality Threshold. However, the actual timing of these deliveries is left up to the discretion of the WRO Operations staff.

NOTES

Due to variations in the ground elevations within each cell, as indicated on each STA hydraulic data sheet, water depths vary throughout the STAs. However, it is the water level (stage) that determines the ability to shunt water within an STA. For example, for STA-1W, water depths range from 0.38 to 1.33 ft, although the water level was essentially level across the four cells (approximately 10.8 ft NGVD).





12. Water Conservation Best Management Practices (BMPs)

DESCRIPTION

Water conservation techniques covered under this option exclude long term water conservation methods that require lengthy operations and financial commitment and may be implemented during periods when there is not a declared water shortage. Techniques under this option are expected to quickly reduce water demand in large quantities only for the duration of the declared water shortage. Some of these methods may be implemented by the District or local governments, while others may require public involvement. Examples of Water Shortage / Water Conservation BMPs include the following:

- Public awareness/ education,
- Media education,
- Emergency water use rate structures,
- Rain gauge distribution,
- Plumbing retrofit device distribution,
- Water shortage enforcement efforts,
- More stringent restrictions, and penalties and fines.

IMPLEMENTATION

The SFWMD would be responsible for initiation of this option during a declared water shortage. Water suppliers and their users would be responsible for implementation in those areas where a water shortage is declared. The proposed techniques used under this option are commonly used throughout the nation under drought/water shortage conditions. A determination must be made to decide which techniques are the most cost-effective for the region or a particular service area. Depending on the technique selected, The resource benefits may be regional, local or both. The SFWMD and/or the water user may provide the necessary services and funding.

TIMING

Declaration of a water shortage is needed to implement this option. The time required for start up is technique specific, and ranges from 2 weeks to several months. This option needs to be implemented immediately upon declaration of a water shortage, in order to realize maximum benefits? If implementation is delayed, benefits will be reduced in proportion to the effective demand reduction for the missed period.

BENEFITS AND COSTS

The potential benefit/cost considerations for this option vary considerably because they relate to changes in lifestyle and business operation for the affected water users. The total monetary costs to implement these techniques (including capital expenditures, manpower, operations and maintenance) also vary over a considerable range, dependent on the technique chosen and the area/population applied. Full implementation of these BMPs could result in over 50% of normal water use being reduced. The cost/benefit ratios (monetary cost per unit of water produced) for this option are technique specific and range from very low to moderate.

13. Water Use Restrictions

DESCRIPTION

The District has authority to impose water use restrictions under the authority of Chapter 40E-21 F.A.C., which is also known as the Water Shortage Plan. The purpose of this chapter is to:

- Protect the water resources of the District from harm
- Assure equitable distribution of available water resources among all water users during times of shortage
- Minimize adverse economic, social and health related impacts
- Provide advance knowledge of the means by which water apportionments and reductions will be made during times of shortage
- Promote greater security for water use permittees

This rule describes the following four phases of restrictions and anticipated reductions in demand.

Phase	Severity	% reduction in demand
I	Moderate	15
II	Severe	30
III	Extreme	45
IV	Critical	60

Restrictions contained in the rule can be modified through an administrative order to address specific conditions. In the course of the recent 2001 drought, restrictions have been implemented on an unprecedented scale. Modified Phase II restrictions have been imposed on the entire Lower West Coast Region, Lower East Coast Region and in the metropolitan Orlando area.

IMPLEMENTATION

South Florida Water Management District has sole authority for implementing water use restrictions under the Water Shortage Plan through execution of a Final Order. However, local governments are required and encouraged to assist the District in enforcement of restrictions of water uses not requiring a Consumptive Use Permit. The majority of local governments within the District's jurisdiction have adopted local ordinances that incorporate the District's water supply rules and take effect when the District declares a water shortage. The process for coordinating the role of local government enforcement is described in Option 21, Local Government Enforcement. The District is responsible for enforcement of restrictions on those water uses that require a permit. The District enforcement process is described in Option 22, District Enforcement.

While the rule describes general conditions for declaring a water shortage, it does not contain specific resource-based criteria for imposing, increasing, decreasing or rescinding water use restrictions. During the course of the recent drought, District staff developed criteria for these purposes and presented them to the Governing Board. These criteria are described in Option 7, Water Shortage Triggers.

Chapter 40E-21 F.A.C., was last revised in 1991 and since that time there have been significant changes in water use patterns in South Florida. Recognizing this fact, the District has initiated

the rule development process to revise the rule chapter. Staff has initiated a series of meetings and workshops with representatives of the various water use classes in order to develop specific recommendations for a revised rule. The rule revision effort will also incorporate the Water Shortage Triggers discussed above.

TIMING

Water use restrictions are imposed based on the conditions of water resources. Generally, restrictions are imposed and/or increased during the dry season and rescinded or decreased during the wet season. The effort to revise the restrictions is well underway, with a goal of reaching consensus prior to the beginning of the next dry season.

BENEFITS AND COSTS

The impacts of the restrictions mostly fall upon the water users and suppliers. Current modified Phase II restrictions have resulted in reductions in overall water use of approximately 10-50%, depending upon the use type (lawn watering, crop irrigation, domestic water supply, etc.). Pumpages for public water supply utilities have been reduced by 10-20% throughout the current drought.

Economic costs of saving water during Phase I and II water shortage restrictions are expected to be in the range of \$300 to \$1,000 per acre-foot of water saved and made available for later consumption. During Phase III and Phase IV restrictions the economic costs of saving water would generally be in the range of \$1,000 to \$15,000 per acre foot of water saved and made available for later consumption. The consequences of the water restrictions may include expenses incurred to reduce impacts of the restrictions, the business and consumer impacts due to the loss of use of the water and costs incurred repair and rehabilitate crops or landscapes damaged during the shortages.

14. Lake Okeechobee Forward Water Supply Pumps

DESCRIPTION

Lake Okeechobee is the primary surface water supply for South Florida. Gated spillways, operated by the South Florida Water Management District, control the release of Lake waters to the primary canal system that convey these flows south to the Everglades Agricultural Area and the metropolitan areas of Florida's east coast. At the beginning of the region's dry season this past December, a multi-year drought resulted in Lake Okeechobee water levels that are far below the regulation schedule. These low stages reduced the District's capability to make gravity discharges from the Lake. A Lake stage of 10.0 ft. was determined as the elevation at which discharges would be reduced to the degree that water supply would be severely impacted.

IMPLEMENTATION

To address the forecast of potential Lake Okeechobee stages as low as 7.0 ft., the District developed a plan to install pumps in the discharge bays of the three spillways. The pumps were required to supply 1400 cfs for a headwater elevation of 7.0 ft. and a discharge elevation of 11.0 ft. This concept involved the installation of fourteen 44,880 gpm (100 cfs), 42" diameter horizontal axial flow electric submersible pumps mounted on steel bulkheads. Two pumps in each of the seven spillway bays. These bulkhead/pump units would be installed in the existing downstream dewatering bulkhead slots of the spillway. The schedule for the design and manufacturing of the complete units was set at ten weeks to meet the forecast Lake stage of 10.0 ft.

The pump manufacturer, MWI Corporation of Deerfield Beach, Florida provided the detailed design for the project and overcame a number of difficult engineering problems including a marginal amount of pump submergence at low water. The bulkheads were composed of two sections. The pumps were mounted on the downstream side of the lower bulkhead section. The top unit bolted to the bottom unit. Four screw jacks per bulkhead section were used to secure the unit in the spillway slot. The discharge portion of the pump was supported off the spillway floor by a structural steel leg.

The design of the electrical system for service to the 125 hp pump motors, was developed by the District. The system included solid state, reduced voltage motor starters, with skid mounted panels, and manual controls. MWI supplied a 50 ft. length of cable from the each pump motor. This cable was routed to junction boxes installed on the spillway's service bridge and connected to the power circuits. Stilling wells with float switches were installed in each bay for low water shut off protection. The power company, Florida Power & Light, provided the required 480 volt service to the three sites.

Contractors were solicited to construct the electrical system and install the pump units. The units were installed and the electrical service connected as they were received from MWI during the month of February as the Lake approached the critical 10.0 ft. A crane lowered the bulkhead sections into position and divers bolted them together. The pump was then positioned by crane and divers bolted the pump to the lower bulkhead section. Manatee screens were also provided and installed in the upstream spillway dewatering slots. The screens were designed by the District and fabricated by Harbor Branch, Inc. The electrical system was installed on schedule by the electrical contractor, Dale C. Rossman, Inc. Lucas Marine, Inc. was the installation

contractor. The District purchased an additional spare pump unit to have on hand in case of a failure of one of the units.

The demobilization of the units has been initiated with transport of the pumps to the S5A pump station for service and storage. The skid mounted electrical panels and bulkhead sections will remain at the spillway sites. Without a significant (e.g. hurricane) rainfall event over the Lake's drainage basin, the forecast is doubtful that the Lake will recover prior to next dry season. It is predicted that lower Lake stages are possible. The pump units will be stored for future re-installation to satisfy the water supply demands of South Florida.

TIMING

The schedule for the design and manufacturing of the complete units was set at ten weeks to meet the forecast stage in Lake Okeechobee of 10.0 ft. Coordination with the power company, Florida Power & Light, was required to ensure that the required 480 volt service was provided to the three sites by the time that the pumps were ready to be installed. The units were installed and the electrical service connected as they were received from MWI during the month of February as the Lake approached the critical 10.0 ft. The units were immediately put into service and typically run continuously for six days a week. The pumps performed flawlessly through the month of June when wet season rain began to satisfy the water demand. The pumps have been demobilized and transported to the S5A pump station for service and storage. The pump can be re-installed when Lake levels recede below 10.0 ft.

PROJECT COSTS

The maintenance and total energy costs for operation of the units were not available in time to include in this document. The manufacture and installation costs for the project were as follows:

Pump units	\$1,882,976
Electrical system	\$ 263,900
Electrical service	\$ 68,956
Manatee screens	\$ 16,273
Installation	\$ 117,237
Removal	\$ 43,282
Spare pump	\$ 105,754
<u>Fencing</u>	<u>\$ 3,981</u>
Total	\$2,502,359

The cost of future deployment should be considerably less since the units and accessories have been purchased and many of the necessary components are already in place

BENEFITS

The primary benefit from this project was the improved ability to deliver water from Lake Okeechobee to meet water demands in the Everglades Agricultural Area and Lower East Coast Service Areas. An estimate of the amount of water provided is as follows:

$$[(1400 \text{ ft}^3/\text{sec} \times 86400 \text{ sec/day}) / (43560 \text{ ft}^3/\text{acre-ft})] \times 6 \text{ days/wk} = 16661 \text{ acre-ft/wk}$$

If the pumps were used for 16 weeks (for example during March, April, May and June), that equates to about $16661 \times 16 \approx 266,000$ acre-ft.

15. Comprehensive Water Shortage Public Education Program

DESCRIPTION

Program components include: media, public information and outreach and education.

Media

Options to consider for a media buy include:

- TV Advertisements and Public Service Announcements (PSAs)
- Radio Advertisements and PSAs
- Billboards
- Internet banners

The media component should also include regular press releases, press conferences, and consider holding daily-weekly press briefings as warranted.

Public Information and Outreach

Options and strategies to consider include:

- Publications – Flyers, Posters, Brochures, Hotel and Restaurant Table Toppers, etc.
- Presentations with scripts about restrictions, water shortage, current conditions
- Signage for use in business, local government windows and outdoor signs
- Displays for use by service centers and at events
- Disseminate information through service centers, field stations, government offices and businesses
- Participation in local and regional events and fairs to disseminate and educate
- Citizen Information Line with phone number published on all materials and news releases
- Responses to requests for public information via the external web site
- Hold employee workshops to communicate current conditions and educate regarding available public information/education materials and the need for employees to act and ambassadors and disseminate information
- Development of comprehensive internal and external web site that includes all available outreach materials and information
- Frequent photographic documentation of events and conditions
- Review and research opportunities at little or no cost to disseminate information (ex: Goodyear Blimp, ProPlayer Stadium PSAs, etc.)

Education

Options and strategies to consider include:

- Mailouts to all elementary, middle and high schools. Include water restriction information students can take home to parents, water conservation videos, educational materials, coloring sheets, etc.
- Consider participation in the Newspapers in Education program
- Hold a water conservation education contest with poster submissions at the elementary level, jingles or lyrics at the middle school level and public service announcements or videos at the high school level

The expected results are increased public awareness of the water shortage restrictions resulting in reductions in water use.

IMPLEMENTATION

The Division of Public Information, Office of Communications and Service Center outreach staff provide support services. In order to effectively implement this options, staff must first determine key messages and strategies for implementation and plan the most effective outreach strategies, events and approaches. The media buy and information campaign are targeted to specific impacted areas -- both local and regional. The media buy is outsourced and funded with the water shortage monies.

TIMING

One of the most essential components is to ensure that water restriction information is timely and accurate. Production times vary depending on event and product.

BENEFITS AND COSTS

Keeping the public informed on water conditions, restrictions and getting water use compliance is essential. Costs are dependent on desired market saturation. Approximately \$934,529 has been spent to date on the 2000-01 Water Shortage Public Education Program. The obvious benefits include compliance with restrictions and reduced water use.

16. Upper East Coast C-23, C-24, and C-25 Basin Options

DESCRIPTION

The St. Lucie Agricultural Area has been under water shortage restrictions since March 2000. The region encompasses Martin and St. Lucie Counties and covers approximately 500,000 acres. The majority of the agricultural industry water supply and flood protection is achieved by three major canals located throughout the two counties. This area is not connected to Lake Okeechobee or the regional system and is totally dependent on local rainfall for recharge. Water restrictions for this area are governed by Chapter 40E-22 F.A.C.

A Water Shortage Order for this region was approved by the District's Governing board on March 7, 2001. This order requires all water withdrawals to cease when stages in these canals fall below 14.0 ft NGVD. Water levels in the C-23 and C-24 canals fluctuated around 14.0 ft NGVD during April 2001. In an attempt to provide some degree of operational flexibility, when canal water levels increased above 14.0 ft, water users in the C-23 and C-24 basins were allowed to pump from 6:00 AM - 12:00 PM daily. If canal stages did not rebound above 14.0 ft NGVD, then water withdrawals from the canals for that day were not be permitted. To date, the C-25 canal has not dropped below the threshold of 14.0 ft NGVD, therefore, water shortage restriction have not been imposed for the C-25 basin.

IMPLEMENTATION

During the period of time that the Water Shortage Order has been in place within the UEC, several ideas and comments have been forwarded to the Martin/St. Lucie Service Center with respect to improving or changing existing orders. These comments and suggestions are summarized in the following section.

The C-23, C-24 and C-25 basins are interconnected, in the sense that water can be conveyed from one basin to another under certain canal stage scenarios. Specifically, in May 2001, the C-25 basin was getting some relief from isolated local rainfall events. As a result, canal stages in the C-25 were approximately 6' higher than C-23 and C-24. This provided the District with a management option to transfer water from the C-25 basin to C-24 and, to a lesser extent, to C-23. These actions revealed that water was easily transferred from C-25 to C-24, but providing additional surface water to C-23 was problematic, due to conveyance limitations between G-79 and G-78 and the inability of G-78 to pass sufficient volumes of water.

Option 1 – Improve conveyance through existing structures

Pertaining to infrastructure and capital improvements, consideration should be given to increasing the conveyance capacity of C-23, between G-79 and G-78 to the original design specification. In addition, replacement of G-78 should be considered in order to maximize the system design and management options. Total monetary costs have not been estimated and will require input from the Operations Department.

Option 2 – Investigate feasibility of improving local drainage facilities

With respect to increasing the District's ability to move water between C-24 and C-23, a partnership between the District and the City of Port St. Lucie may provide an avenue of increased conveyance. Specifically, the City of Port St. Lucie has a series of canals and ditches that run perpendicular to C-24 and C-23 canals. These series of canals and ditches could potentially be utilized to transfer water between the two basins. Preliminary discussions with

Port St. Lucie engineering staff indicates that this option is viable and would require a pump to lift water from C-24 into the Port St. Lucie system and then to C-23. Further investigation and discussions with the City is needed in order to finalize logistics, liabilities and monetary costs.

Option 3 – Reservoir at the site of Schirard Citrus sand mine

Historical records indicate that C-23 and C-24 basins typically have reduced water supply during periods of extended drought. Under certain stage scenarios water is easily transferred from C-25 to C-24, but not to C-23. Utilization of additional water supplies within the C-23 basin would prove beneficial to area growers within the basin. Specifically, a 200-acre sand mine (surface waterbody) is located adjacent to the C-23 canal. The mine is on CR609 (Range Line Rd) just north of the Martin Correctional Institute and is currently in private ownership (Schirard Citrus). A roadside ditch associated with CR609 runs adjacent to the mine, providing access to C-23 through PC25A. This option was briefly investigated in April, 2000, at which time the C-23 was at elevation 15.0' NGVD, while the mine was at elevation 21.0' NGVD. This could have potentially provided 500 – 800+ acre-feet of additional surface water to the C-23 basin. In addition, the Mine is currently bermed around approximately half of its perimeter, therefore, the mine potentially could be used a water storage facility for the basin. As previously mentioned, the mine is currently in private ownership and would preferably need to be in State ownership in order to effectively operate and maintain the facility. Monetary cost estimates and liabilities have not been pursued.

Option 4 – extending pumping time to 12 hours a day

During the time period when C-23 and C-24 were under restricted pumping timeframes (6 AM – 12 PM), it was brought to the District attention, that older groves with flood irrigation systems could not move the necessary amount of water to blocks of citrus that were located some distance from the C-23 canal. Area growers have asked the District to consider extending the pumping time for these growers or allow pumps on one side of the canal to pump for 12 hours a day, then allowing the opposite side to pump for 12 hours the following day. Logistics, as to the number of pumps per side and their permitted allocations has not yet been calculated. Once the inventory and calculations have been made it is recommended to meet with area growers to solicit their input and recommendations regarding the changes in pumping timeframes.

TIMING

- Option 1 -- Time needed to bring facilities to specifications and replace structures.
- Option 2 -- Time needed to further investigate and discuss with the City to finalize logistics, liabilities and monetary costs, costs to improve canals, and construct lift pump station.
- Option 3. Time needed to develop designs, determine feasibility purchase lands, construct facilities
- Option 4. Time needed to a) compile data and conduct analyses and determine logistics, as to the number of pumps per side and their permitted allocations b) conduct meetings with area growers to solicit their input c) develop final recommendations, and d) incorporated changes into rules or procedures.

COSTS AND BENEFITS

Benefits of these options have not been quantified but occur primarily to local agricultural water users in the UEC basins. Costs of these options vary substantially depending on the need to construct, improve, operate and maintain facilities as well as administrative costs of review and approval processes.

- Option 1 -- Total monetary costs have not been estimated and will require input from the Operations Department.
- Option 2 -- Further investigation and discussions with the City is needed in order to finalize logistics, liabilities and monetary costs.
- Option 3 -- 500 to 800 or more acre-ft of water. Cost not determined
- Option 4 -- Primarily administrative costs to SFWMD staff

17. Caloosahatchee River At-Risk Utilities

DESCRIPTION

At this time there are two utilities which withdrawal water from the Caloosahatchee River, and during a severe drought will be affected by two factors, lack of water being released by the district from Lake Okeechobee and the threat of saline water encroaching eastward through the Franklin locks (S-79). Both utilities are located approximately 0.8 miles to the East of the S-79 structure. The two utilities are the City of Ft. Myers and Lee County's Olga Water plant.

City of Ft. Myers

At this time, the city withdraws water from the Caloosahatchee River and pumps it south to their wellfield located at the intersection of S.R. 82 and Ortiz Ave. The water is discharge into a series of ditches and is allowed to percolate into the surficial aquifer. Water is then withdrawn back out of the ground from a series of surficial aquifer wells, treated in a reverse osmosis plant and distributed to the customers.

Lee County Olga Plant

Water is withdrawn from the Caloosahatchee River and treated using the conventional method using alum, followed by airification and finally using sodium hypochlorite to treat for bacteria. The water then distributed to the North Ft. Myers, and Olga/East Lee County areas.

IMPLEMENTATION

City of Ft. Myers

The City has already constructed multiple Lower Hawthorn aquifer wells to be utilized through the reverse osmosis plant. This will allow the City to abandon the use of the Caloosahatchee River completely. The city feels that by January of 2002 they will be able to switch over to the Lower Hawthorn wells and with special permission from the State DEP discharge the brine water to the river on an emergency basis if needed.

Lee County Olga Plant

The County has several options to combat this problem. The long-term solution is to construct a reverse osmosis plant in North Ft. Myers. The County is close to completing on the land acquisition and is currently selecting a contractor for construction.

In the event of a drought before the construction is complete, the County has started to store water in an Aquifer Storage and Recovery (ASR) well at the Olga plant. This well can store approximately forty million gallons of treated water. An additional one hundred and fifty million gallons of treated water can be stored in five Corkscrew ASR wells.

In addition, the County can utilize wells from the North reservoir area, and has an open agreement with the City of Cape Coral to open an interconnection and purchase water to service the Waterway Estates Area. They are hoping that an agreement can be reached with the City of Ft. Myers to help supplement the Olga plant service area. Enhancements to the Collins Street pump station were needed to enable the County to maneuver water and provide service to different areas and to relieve stress to the Olga plant.

Lee County is also looking at the possibility of two additional options, the first is to make contact with Hawk's Haven a recently permitted project to the south of the Olga plant. The idea is to utilize their Sandstone Aquifer wells for the Water plant and provide Hawks Haven with surface water for their irrigation needs.

The second option is constructing Sandstone Aquifer wells along East Lee County's Right of Ways south of the Olga plant. . The County has yet to meet with the representatives of Hawk's Haven to discuss costs and the feasibility of that option.

TIMING

At this time, the City of Fort Myers plans to obtain approval from the City Council in September 2001 for the construction of an injection well, which they estimated will be completed by July of 2002. Lee County Utilities estimates that construction of the reverse osmosis plant will begin within six months.

COSTS AND BENEFITS

When completed, the City of Ft. Myers estimates that their costs will be at seven million dollars. And then they will not be dependent on the river at all.

The cost for the Lee County reverse osmosis plant is estimated at twenty five million dollars. Lee County has already spent forty thousand dollars to make enhancements to the Collins Street pump station. The estimated cost of constructing Sandstone Aquifer wells along East Lee County's Right of Ways is one point six million dollars.

18. Lake Okeechobee Public Water Supply Utilities Raw Water Intakes

DESCRIPTION

The purpose of the project is to insure continuous and uninterrupted water supply to existing utilities with Lake Okeechobee surface water sources as a result of forecast record low Lake stage. The design assumes a need for long and continuous service that may last well into the next wet season and may be required for the subsequent dry season. It should also be noted, the existing utilities have less than 24 hours available water storage with failure of the intake. The selected alternative must therefore be operational within this period. Given the possibility the proposed facility will have a long service period and will likely be exposed to severe weather or open water conditions, the following design objectives and desired features were established:

- d. reliability by use of redundant systems
- e. reliability because of a robust design
- f. designed for future high Lake stages
- g. designed for continuous long term service to address the potential of a multi-year drought
- h. design addresses vandalism and public safety concerns
- i. operates to a low Lake level of 6.0 ft.
- j. 60-day implementation
- k. minimizes risk of delay
- l. design addresses major maintenance
- m. pump capacity satisfies plant demand

IMPLEMENTATION

The following considerations were incorporated in the design and contract package development:

- n. Incorporate resources of cities including use of consulting firms under contract to develop conceptual and detailed design.
- o. Develop design and build strategies that have the shortest implementation schedule.
- p. Designs shall minimize permit requirements to expedite implementation schedule.
- q. Use District resources to expedite implementation schedules.

City of Pahokee:

The existing intake consists of a single 14 in. diameter asbestos cement (AC) and ductile iron supply, (suction), line with a screened intake tee outside of the marina channel, 825 ft. west of water plant. The Lake bottom at the intake is approximately elevation 6.2 ft. The current modification of the intake is considered effective to a Lake stage of 9.0 ft. The two intake pumps are located in the treatment plant south of the levee and draw water from the Lake through the 14 in. diameter, AC-iron supply line. This supply line currently obtains water from the Lake outside

the influence of the poorer water quality of the marina. The city desired to keep the existing intake for future use because of this preferred water quality.

There is no backup system for the intake supply pumps. The operator's emergency plan, given the inability to prime his pumps, was to connect a portable pump unit to an existing cleanout tee in the suction line near the water's edge to supply the existing pumps. The city has a mobile pump that has been used on occasion for this purpose. However, because of the receding shoreline, the city lacks sufficient suction/discharge line. It also was obvious the temporary supply system would be in place for several months. Therefore, SFWMD rented sufficient line, a 250-gallon, skid mounted fuel tank, and two skid mounted diesel driven pumps for the city's use until the selected alternative is constructed and tested. When this system was connected and operational, it was discovered the A/C to iron pipe connection, (before this date it was unknown that there was A/C pipe under the levee), had a severe leak and this plan was not effective. Additional line was rented to go over the levee directly to the plant. It was also determined the A/C line was badly deteriorated and required rehab. A contractor was solicited to slip line the existing line with a 10' polyethylene pipe.

The design alternative included a wetwell and valve box with duplex electric submersible pumps located adjacent to the fishing pier. The pumps were sized to supply the current plant demand of 1200 gpm at a total head of 44 ft. A 220 ft., 24 in. diameter polyethylene (HDPE) intake line with grated intake supplies water to the well from deep water located near the north end of the fishing pier. A 14 inch diameter discharge line connects to the existing suction line at the A/C-iron connection. At the request of the plant manager, the intake pumps were sized to be capable of discharging directly to the plant treatment tank. A bypass around his existing pumps at the plant was provided. The electrical service and control is from the plant.

City of Bell Glade:

The current intake pump station was formerly a booster station and has undergone several modifications including the abandonment of the Torry Island intake and the conversion of the booster station to the intake. The original station had two 18 in diameter, 4600 gpm, 200 hp turbine pumps in 36 in. diameter cans. A third variable speed 250 hp pump was added and connected to the intake and discharge piping. The 36 in. diameter steel intake pipe has an invert elevation of 2.6 ft.

The two original pumps are currently out of service because of cavitation problems that occurred with the Lake stage at approximately 10.5 ft. The performance characteristics of these pumps are not known. Because of the modification to draw water from a gravity intake line in lieu of being supplied water from the original intake station, it is suspected the original pump design was significantly changed. The variable speed pump is currently operated at a greatly reduced speed to reduce the submergence and NPSH required.

The city has just completed a new submersible pump intake drawing from a rock pit on Torry Island with its discharge line connected to the old supply line to the booster station. The purpose of this intake is to provide water of good water quality that would be blended with the waters of the rim canal at the current intake. The performance testing of the new campground station indicated a significant time to recharge the pit. This station can not be considered as a continuous source of supply but will provide approximately one day of available storage given the shut down of the rim canal station.

The emergency plan required the mobilization two temporary pumps to be run in parallel at the existing rim canal intake. These pumps were connected to the proposed new tee connection to the existing 20" ductile iron supply line.

The initial design focused on a wetwell and valve box with two submersible electric pumps constructed adjacent to the existing raw water pump station. The wetwell is supplied by gravity through a 30 inch diameter HDPE supply line with a grated precast concrete intake. The discharge line connects to the existing 20 inch diameter supply line that connects to the plant approximately 13,000 ft. to the south. The pump rating point is 4000 gpm and 90 ft. of total head. On initial pricing of the job it was disclosed the submersible pump cost and delivery time for this relatively large unit exceeded our initial estimate. Also the construction of the deep wetwell would require significant sheeting. It was decided to design an alternative that consists of two turbine pumps mounted on a precast concrete pile supported platform with access ramp. The pumps are to use the current service from the existing station. Quotes for both alternatives were requested because the city desired the wetwell alternative.

The city expressed concerns after the bid about navigation in regard to the platform's proximity to the channel. This concern was also expressed by the Corps after the bid. To address these concerns the platform was relocated 60+ ft. to the north, farther from the Torry Island bridge restriction. However, the Corps did not want the platform any further out in the channel than the bulkhead of the existing intake. Therefore, a steel sheet pile bulkhead was designed to allow the platform to be located in the canal bank.

City of South Bay:

The intake consists of an elevated pump house on concrete pile located in the rim canal. The canal bottom elevation at the intake is -1.0. Three 750 gpm turbine pumps with 15 hp motor drivers are manifolded to one 12 inch and one 8 inch ductile iron supply pipe. The bottom of the pump bells were estimated at elevation 7.0 ft. One pump is sufficient to meet the plant's demand. One pump was down because of a mechanical problem. The other pumps' flow rate appeared to vary directly with the Lake stage, especially when the upper stage bowl is exposed. The pumps were apparently operating in a range far from their best efficiency point, resulting in an increase in the NPSH required. There were no records available on the low stage assumed in the pump design rating.

Since the canal bottom beneath the platform had sufficient depth, the alternative of simply replacing the pumps was deemed the most cost effective solution. It was determined, because of the significant risk of failure, WRO personnel would take immediate action to replace each of three turbine pumps with ones with the performance characteristics that satisfy the projected low Lake stage of 6.0 ft. All pumps have been installed and are operational.

During the pump installation by WRO personnel, movement of the platform was noted with wave action within the rim canal. A design to rehab the platform was completed and contractors are being solicited to make the improvements.

City of Okeechobee:

The intake is located in the Government Cut Channel with a 30 inch diameter supply pipe at an invert at 6.2 ft. to 6.4 at the pump station. The intake is approximately 600 ft. south of the pump station. The pump station has 2- 10 inch, 3000 gpm and 1- 8 inch 2000 gpm mixed flow pumps. The 24 inch diameter discharge line from the station extends 650 ft. under the rim canal and over

the dike to the plant. Electric service is from the plant. The plant demand was indicated to be 3800 gpm. This requires the city to operate two pumps at a time to meet this requirement. The intake station appeared to be in good condition.

It is believed the pumping system of the existing intake has the capability of operating to a low Lake stage of 8.5 ft. based on the assumed submergence of the mixed flow pumps. It is not known at what elevation the pumps will begin to experience performance problems. There is no backup to the existing intake. The emergency plan mobilized a temporary centrifugal pump at the edge of water to pump into the intake until the permanent replacement station is completed and operational.

The city has a planned plant improvement (next 18 months), that includes the replacement of the existing raw water intake. They requested the new intake be designed to satisfy the new plant design.

A temporary pump installation would have significant exposure of the equipment, piping, etc. to severe weather and open water conditions. Therefore, such an installation was not considered secure and reliable and did not satisfy the project objectives. The sole alternative considered was a new wet well and valve box with duplex electric submersible pumps. Use of platform mounted pumps was not considered because of the long distance required for an access walkway and the exposure of such a platform to severe wind and open water conditions. The site of the wet well was adjacent to the existing station to limit the distance to the connection to the existing discharge piping. The quoted design sized the pumps at 2800 gpm at a total head of 35 ft. in order to utilize the existing electric service. To meet demand, both pumps would be required. The city objected to this and requested 3800 gpm pumps be installed to provide redundancy. This design requires a significant upgrade of the electrical service to the station as well as increased equipment costs. The design was completed after the quote day and subsequently a price was obtained from the low quote contractor. The recommendation is to supply the larger pumps and electrical system.

The new facility included a 450 ft., 36 inch diameter intake line with screened intake for gravity feed to the well. The regulatory agencies were consulted in regard to a channel approach to the wetwell and elimination of a significant portion of the intake line. The Corps, however, has specific language in their regulation that denies any permit exemptions when there is modification of the Lake bottom topography. The required permit process for this design would require several months and was therefore not pursued.

City of Clewiston:

The primary intake and pump station is located approximately 4 miles northeast of the city. It was built in 1943 and located out in the Lake for what are assumed water quality reasons. The station consists of a 40 ft. diameter reinforced concrete dry/wet well intake with three 14 in. diameter centrifugal pumps -- two electric driven 2100 gpm pumps and one diesel driven 5600 gpm pump. The water enters the wet well through a 5 ft. x 5 ft. gated opening with a sill elevation of 5.3 ft. The pump discharges are manifolded to one of three 24 in. diameter supply lines. The treatment plant has a backup intake on the rim canal which consists of a 12 inch diameter, 5000 gpm, 125 hp, variable speed electric motor driven turbine pump in can. The 14 in. diameter intake to the pump has an invert of 4.3 ft.

Both the primary station in the Lake and the backup pump at the rim canal are considered by U.S. Sugar at risk below Lake stages of 8.5 ft. The performance characteristics and the system curves for the stations and discharge lines were not provided. The Lake bottom in front of the primary intake is more or less elevation 5.0. Therefore, with extreme low water it appeared the Lake site would require a channel be excavated to deeper water, (none found by soundings for several hundred feet). The rim canal station was the focus of emergency action both because of the obvious convenience as well as the deeper water found in the rim canal.

There was some discussion of use of a portable diesel driven pump to supply water into the Lake intake by sand bagging the wetwell opening and piping water over this plug. The duration of this operation as well as the difficulty of supplying fuel and/or emergency service eliminated this alternative from further discussion. Also, with the assumption of an extreme low Lake stage of 6.0 ft. this site was not feasible.

A portable hookup to the rim canal pump is possible with the removal of the intake line strainer and connection of the pump's discharge to the 14 inch diameter intake line at the tee. The portable pump would be sized and operated to feed the existing pump. This is the current emergency plan given both stations are shut down. In lieu of pumping into the intake it was decided to install the piping for the selected alternative from the connection to the existing 12 inch supply line to some point where a connection could be left for the portable pump.

The initial design alternative was a wetwell with a duplex submersible pump system. On review of the costs, a platform mounted turbine pump alternative was designed. U.S. Sugar Corp desired a diesel engine driven pump so two alternatives were prepared, one with an electric motor drive, one with diesel engine driver. The platform was designed for one pump with U.S. Sugar agreeing to a single installed unit with one backup pump provided. They indicated they could easily and quickly replace the pump if necessary.

The drawings that were quoted failed to indicate the need for a spare pump for the diesel driven alternative, the electric motor alternative did have a second pump to be supplied as a backup. Therefore the diesel driven alternative quoted was \$20,000 less than the electric motor driven alternative. U.S. Sugar was given the choice of the diesel alternative less the backup pump or the electric motor alternative with the second pump. They selected the electric motor alternative. Therefore the selected alternative consists of one electric motor driven turbine pump rated at 4800 gpm at 70 ft. of total head. The pump will be mounted on a reinforced concrete pile supported platform with access ramp. The pump can use the current service to the existing rim canal intake pump without modification.

COSTS AND BENEFITS

The summary of project costs is as follows:

South Bay	pumps	\$27,845
Pahokee	intake	\$465,000
Belle Glade	intake	\$371,132
Okeechobee	Intake	\$619,112
Clewiston	Intake	\$340,300
Subtotal		\$1,829,239
TOTAL*		\$1,997,300

*includes misc. additions such as security, temporary pumping costs, platform rehab. and changes.

The summary of project benefits in terms of increased capacity is as follows:

South Bay	2250 gpm
Pahokee	1200 gpm
Belle Glade	8000 gpm
Okeechobee	7600 gpm
Clewiston	<u>4800 gpm</u>
TOTAL	23,850 gpm

Construction of these facilities, in general thus provide a total capacity of about 24,000 gpm (35 MGD or 105 ac-ft/day), ensuring that the plants can operate during the period when Lake levels declined below 10 ft NGVD and continue as long as the Lake level remains above 6.0 ft. The Lake was below 10 ft for approximately 100 days from April 15 to July 22 2001.

19. Ground Water At-Risk Utilities

DESCRIPTION

There are 16 identified “at-risk” utilities with coastal wellfields in the District’s Lower East Coast. These utilities operate wellfields near the Atlantic coast and outside the influence of District regional canals. As water levels in the aquifers and the ability of the District to convey water from regional storage decrease, the potential for saline water intrusion increases. In total these utilities serve approximately 0.5 million people.

As a result of the higher susceptibility to drought induced saltwater intrusion, each of these utilities is required, under District water shortage order 2001-48 DAO WS, to collect weekly pumpage, water level and chloride data. These data are submitted to the district Staff for review. Should instability in the coastal saltwater interface occur as evidenced by monitor data, the affected utility shall implement a water shortage contingency plan in order to minimize saltwater movement. The plans include three elements that are deployed based on the degree of saline water movement. The three plan elements are: a) alternating pumpage operations to shift stress away from the interface, b) purchasing water from other utilities, and c) imposing additional water restrictions within their service area.

TIMING

This option is currently being implemented

IMPLEMENTATION

The affected utilities collect the data and submit reports to the District. The Water Use Division evaluates the data and oversees implementation of the utilities’ water shortage contingency plan. The contingency plans are triggered by district staff when two or more consecutive weekly chloride readings show a greater than 10% increase above a base chloride level determined for each monitor well, which is defined as one standard deviation above the mean chloride level.

BENEFITS AND COSTS

The benefit of implementing this option is to minimize lateral saline water intrusion on a local scale. The fresh groundwater resources are protected by careful wellfield operation and monitoring. Continued supply of fresh drinking water and the protection of existing wells and treatment facilities are the benefits to consumers. This option supports the utilities in producing their water shortage based allocations in a manner that minimizes the risk of salt water intrusion during drought.

There is a small increased cost to the utilities associated with increased monitoring and reporting. The District also spends additional time recording, evaluating and interacting with the subject utilities on a weekly basis. The implementation of this option does not necessarily produce an additional savings of water as compared with other utilities in the LEC.

20. Water Supply Improvements for C-40 and C-41 Canals

DESCRIPTION

The District can supply water from Lake Okeechobee to the Brighton Reservation and the southern portion of the Lake Istokpoga-Indian Prairie Basin through G-207 and G-208 pump stations via the C-41 and C-40 Canals. These pumps can be operated during low water stages within the intake to approximately 7.0' NGVD. However, the lake bottom is exposed at the terminus of the canals when the Lake Okeechobee levels fall below 9.2' NGVD. This option examines water supply delivery improvements to both canals by dredging each the appropriate distance further into Lake Okeechobee such that a physical connection between the lake and the canals exists to a lake stage of 7.0' NGVD. The proposed method of excavation is most likely to be by hydraulic dredge.

IMPLEMENTATION

The District has responsibility for determining if this option should be implemented. However, since the lake bathymetry will be modified, permission from the ACOE must be granted before implementation of this option. Pre-dredging activities will include surveys, geotechnical analysis of the substrata in proposed dredging areas, spoil site preparation and permitting. Preliminary scope of this dredging project entails extending the length of the C-40 channel approximately 5,000 feet, and the C-41 channel approximately 3300 feet. The District controls rights-of-way along both channels adequate for disposal of the dredged material. Excavation quantities based on a neat volume calculation are 13,889 cubic yards for the C-40 channel and 16,378 cubic yards for the C-41 channel.

TIMING

A 120-day construction duration is estimated for each of the canal improvements; however, the work could be performed simultaneously. A start date of early October 2001 would be required in order to complete the dredging prior to projected lake levels dropping below 9.2' in February 2002, a “worst case” scenario potential.

BENEFITS AND COSTS

This option would enable the District to deliver Lake Okeechobee water to the Brighton Reservation via G-207 and G-208 in the potential event lake levels fall below 9.2' NGVD during the 2001 – 2002 dry season. If the canal improvements are made, G-207 and G-208 would each have the capability to pump approximately 111.4 cfs from a lake stage of +7.0' NGVD to the Brighton Reservation and the southern portion of the Lake Istokpoga-Indian Prairie Basin. These pumps could thus deliver about 400 acre-ft/day. By making the proposed improvements, and if they were operated at capacity, six days per week, for 14 wks, a total of 33,600 acre-ft of additional water could be provided to the reservation.

The preliminary construction cost estimate for this option, assuming a total of 30,267 cubic yards excavated by hydraulic pipeline dredge and the material spoiled along existing District rights-of-way, is approximately \$450,000.

21. Local Government Enforcement

DESCRIPTION

The South Florida Water Management District and the local governments within our jurisdiction have a shared responsibility in the enforcement of water shortage restrictions.

IMPLEMENTATION

County sheriff offices, local police departments and municipal and county code enforcement officials have the responsibility for the enforcement of water shortage restrictions at the local level of government. The local departments and agencies provide the funds for staff time to enforce water shortage restrictions. The South Florida Water Management District supplies warning tickets, water shortage violation tickets, and Water Shortage publications for distribution to assist in enforcement activities.

The South Florida Water Management District establishes the Water Shortage Phase within particular geographic areas. The local governments are then responsible for the local enforcement of the restrictions associated with the Water Shortage Phase established by the District. When the District declares a Water Shortage and restrictions are imposed, members of the water shortage team and the Service Centers hold a series of enforcement taskforce workshops to coordinate and educate the local authorities concerning water shortage enforcement at city and county levels. Compliance/Enforcement Workshops or “Cop Shop” meetings are held in the counties affected by restrictions. The purpose is to explain the various laws and assist the municipalities to establish the policies and strategies that are needed to enforce the Water Supply Order Warning tickets and violation tickets are printed by the District and made available to local government sheriff offices and police and code enforcement departments.

To track the effectiveness of utility conservation programs and water supply delivery reductions during water shortages monthly utility pumpage reports are produced by the Water Supply Permitting Division. The reports are produced the Friday before the next regularly scheduled Governing Board meeting to provide current information for the Monthly Water Shortage Status Report presented to the Governing Board.

In addition, Service Center staffs compile information from the local governments within the county or area served by the Service Center. At the beginning of each week local governments report to the Service Centers on enforcement activity within their jurisdictions. They provide details regarding the number of water shortage warnings, water shortage violations, citations issued and the number and number of fines imposed.

Complaint calls from the Phone Bank are mapped. Analysis of the calls indicates local communities that may have enforcement problems. Smaller communities can find their staff resources quickly exhausted with additional enforcement responsibilities when a water shortage is declared. The District provides funds to help communities augment existing enforcement staff resources for water shortage restriction enforcement.

Weekly teleconferences are held with the Service Centers to monitor the level of water shortage enforcement participation by local governments. This forum produces regionwide information

that provides the location of problem areas and the prompt identification and coordination of solutions.

This option is implemented in every region within the South Florida Water Management District declared to be under a Water Shortage. The water resource management benefits accrue locally and regionally.

TIMING

This option must be implemented within two weeks of a water shortage declaration. The immediate actions taken by the District and local governments emphasize the importance of the required cutbacks. If implementation is delayed there will be less emphasis on the seriousness of the water shortage. Reduced compliance with the restrictions imposed on the residents of an area or region may also result.

BENEFITS AND COSTS

Reductions in potable and non-potable water usage achieved through local enforcement of water restrictions are considered to be the water resource or non-monetary benefits of this option. Approximately 50 percent of urban water withdrawals are used for irrigation purposes. The primary purpose of local enforcement of water restrictions is to reduce the amount of urban irrigation during a water shortage. Water usage cutbacks are required in each phase of water restriction. The required cutbacks are expected to achieve a goal, by phase, in the reduction of water usage within specific counties or by utility service area.

It is difficult to be accurate about how much water can be saved through reductions in water used for irrigation purposes, especially by local enforcement of water restrictions. In general, in a water shortage, if local groundwater and surface water levels are maintained at acceptable elevations then local enforcement of water restrictions is considered to have contributed to the success of achieving that goal.

The monetary costs to the District of local enforcement of water restrictions are a combination of the printing of publications, the printing of water restriction violation tickets and media buys. \$1,200,000 is a preliminary estimate of costs associated with those activities.

22. District Water Shortage Compliance/Enforcement

DESCRIPTION

All water use permits issued by the District contain a limiting condition that requires the permittee to comply with District water shortage orders and rules. The District is authorized to enforce the limiting conditions of permits issued pursuant to Chapter 373 F.S. through fines up to \$10,000 per day and or revocation of the permit.

IMPLEMENTATION

The following is a summary of the procedures that the District implements in order to enforce the water shortage limiting conditions of permits:

- The District's compliance/enforcement water shortage initiative is comprised of two components. The agriculture component consists of inspections conducted both aerially and on the ground. Compliance of this initiative occurs pursuant to the formal declaration of a water shortage.
- Compliance inspections for both initiatives are conducted with District staff from numerous departments (approximately forty staff members). The locations of these inspections/sweeps are determined both randomly and from complaints received through the District's phone bank.
- Unauthorized uses of water and District right-of-way are documented by District staff using field reports specifically designed for the water shortage. Compliance staff are provided training on the use of the forms, as well as how to properly document a violation (photographs/time/date/inspector).
- All field reports are then submitted to the Water Use Division's Compliance Section and reviewed/compared with permit files regarding the unauthorized use. The Water Use Division maintains an updated ledger for those projects receiving variances, as well as those on reuse/mix so that the projects are not inadvertently issued notices of violation. For those alleged violations in which it appears that a structure (i.e. pump) has been placed on District right-of-way, the District's Right-of-Way Division reviews the field report and confirms ownership.
- Once the field report is reviewed and the alleged violation confirmed, the file is sent to the Environmental Resource Compliance Division's Enforcement Supervisor.
- Based on the volume of water permitted for the project (extent of deviation), the number of previous offenses and whether the user of water has a valid permit, a penalty is assigned using a schedule that is developed specifically for the water shortage. If the violation involved District right-of-way, an additional fine is imposed for the infraction.
- A standardized "Notice of Violation/Short-Form Consent Agreement" which includes the assigned penalty and provisions that the permit holder must implement in order to resolve the violation is sent to the respondent.
- The permittee either agrees to the provisions of the consent agreement or refuses. If the permittee/respondent agrees to the consent agreement (by his or her signature), the District's Governing Board approves it at the next regular meeting. If the

permittee/respondent refuses to sign the consent agreement, staff refers the file to the District's Office of Counsel and requests litigation authority from the Governing Board to resolve the matter in court.

- If a permittee/respondent violates the provisions of the water shortage on more than one occasion or refuses to cease, an increased penalty is imposed.

TIMING

This option is implemented immediately upon the effective date of any Water Shortage Order and continues until the order is rescinded

COSTS AND BENEFITS

All penalties collected through enforcement actions were deposited into the Water Management Lands Trust Fund and recovered staff costs are deposited into the District's General Revenue Fund. As of July 15, 2001, The District has documented 598 water shortage violations which amount to \$362,000 in civil penalties and costs.